BALLY MANUFACTURING CORPORATION a Delaware corporation,

Plaintiff/Counterdefendant,

vs.

D. GOTTLIEB & CO., a corporation, WILLIAMS ELECTRONICS, INC., a corporation, and ROCKWELL INTERNATIONAL CORPORATION,

Defendants/Counterplaintiffs.

Docket No. 78 C 2246

Chicago, Illinois
March 15, 1984
10:30 a.m.

VOLUME XIV-A
TRANSCRIPT OF PROCEEDINGS
BEFORE THE HONORABLE JOHN F. GRADY

TRANSCRIPT ORDERED BY: MR. JEROLD B. SCHNAYER
MR. MELVIN M. GOLDENBERG

APPEARANCES:

For the Plaintiff/
Counterdefendant:

MR. KATZ
MR. SCHNAYER
MR. MATHIAS
MS. SIGEL

For the Defendants/
Counterplaintiffs:

MR. LYNCH
MR. HARDING
MR. GOLDENBERG
MR. ELLIOTT
MR. RIFKIN
MR. GOTTLIEB

Court Reporter:

LAURA M. BRENNAN
219 South Dearborn Street, Room 1918
Chicago, Illinois 60604

THE CLERK: 78 C 2246, Bally Manufacturing v. Gottlieb, case on trial.

MR. MATHIAS: Good morning, your Honor.

THE COURT: Good morning.

MR. MATHIAS: Mr. Tone has a mandatory Court appearance this morning in the Federal District Court of Cleveland. He will be here for this afternoon's session but will miss this morning's session.

He asked me to report to you that he would have advised you of this yesterday had he known that his attendance would be mandatory.

THE COURT: All right, thank you.

JAMES SCHOEFFLER, PLAINTIFF'S WITNESS, PREVIOUSLY SWORN.

THE COURT: Good morning.

THE WITNESS: Good morning.

MR. LYNCH: Good morning, your Honor. May I proceed?

THE COURT: Good morning, Mr. Lynch. Yes, please.

CROSS EXAMINATION (Continued)

BY MR. LYNCH:

Q For the record, I would like to mark for identification the chart comparing Flicker, the embodiment of the '441 patent, Cleopatra and Spiderman as Exhibit 19-J, and as one brief clarification, Dr. Schoeffler, you indicated that the low beta transistor found some correspondence in the Gottlieb

games in the transistor with the resistor that current limited the lamps during turn-on, correct?

A. That is my understanding, sir, that is correct.

Q. The slow turn-on transistor which gives the lag sensing function did not find a correspondence in Cleo or Spiderman, correct?

A. There is no slow turn-on transistor that is as slow as the corresponding one in the Flicker game, that is correct, sir.

Q. With respect to Cleo and Spiderman, furthermore, it is the case that these solenoids that you indicated were not driven can, indeed, be activated at any time during the game cycle, correct?

A. That is correct, on the solenoid row, it is true of all four entries, not actually just of the two, that some are driven and some are not driven, and the direct drive ones can be driven or caused to actuate, such as the flippers, at any time.

Q. But in the Cleo and Spiderman, there are a great deal more solenoids that are not driven, correct?

A. In the Cleo and the Spiderman, approximately half the solenoids are driven under control of the microprocessor, the other half not under the control.

All of them are enabled as a group by the microprocessor, however.

Q. They are enabled by the tilt switch, you mean, not being activated or by the initial turn-on switch?

A. Well, but that is under microprocessor control.

Q. In the context that the tilt is under microprocessor control and that when the tilt goes on, tilt switch goes on, the game shuts down, correct?

A. That is correct, and without examining the program, it must also be true that when the game is over, these must be deactivated so that you can't play with the flippers, which is the identical procedure that is done in the Flicker game, sir.

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Q. I understand. The identical procedure that was done in electromechanical games, correct?

A. Yes, sir.

Q. Now, but the point is, is that the half of the solenoids that are not driven in the Cleopatra and Spiderman game, those could be creating noise during a switch cycle, correct?

A. In the same way that the solenoid not in the -- solenoids not in the Flicker game that are direct driven, namely the flipper solenoids, can be actuated at any time, that is, not synchronized with the computations, they may be a source of noise.

The major difference is, as indicated on this chart, that the solenoids in the Cleopatra and the Spiderman games are DC solenoids, with the steering diode across it. So that the amount of noise, as we indicated in the testimony yesterday in response to your question, is very much lower in this case.

Q. So Cleopatra and Spiderman do not avail themselves of that advantage you discussed whereby the solenoid activation is placed in a portion of the cycle remote from the switch sensing. Correct?

A. That is not quite correct, sir.

What I testified was not that the actuation of the solenoids was, but it was at a point in time when the solenoids were no longer activated.

Then in the Flicker game and program we took advantage of that to do the long computational routines that might have been subject to that noise.

In the case of the Cleopatra and Spiderman, the same offset is done for the solenoids that are under control.

Q. But not for the half that are not under control.

A. For the direct driven ones, in both the Flicker and the Cleopatra and the Spiderman, that is not done.

Q. Now, you also indicated that there is a low beta transistor finds some correspondence in Cleopatra and Spiderman.

It is the low beta transistor that prevents the onrush of current to the lamps that is specifically claimed --

A. That is correct, sir.

Q. -- in Claim 29 of the patent. Isn't that correct? And I show you Exhibit 1.

A. That is, specifically the Claim 29, in Claim 29.

Q. So this item, that is, low beta on Exhibit 19-J, and that you testified finds some correspondence with the transistor and resistor, is specifically claimed in a claim not in suit, correct?

A. Claim 29 is not in suit.

Q Now, if you would step over to the Flicker game, please--

A Sir, that answer is -- my answer was incomplete there. May I correct it just a bit?

What I said was in fact true, that claim 29 does claim that.

But the low beta transistor is one of the noise prevention techniques which pervades the thesis and appears in the other claims that are in suit.

For example, in claim 45, as we have testified, from the means plus function language, going back to the operative matrix multiplexing, we determined that noise prevention and noise immunity were part of those claims.

And the low beta transistor is clearly part of those claims. So although it is specifically mentioned in claim 29, it is also a part of claim 45 at least.

Q Well, now, you did testify about claim differentiation yesterday.

A Yes, sir.

Q Now, according to claim differentiation, the low beta transistor is mentioned in one claim, correct, specifically?

A It is specifically mentioned in claim 29.

Q It is not specifically mentioned in claim 45.

A It is in claim 45 through the means plus function language.

Q It is not specifically mentioned in claim 45, correct?

A. The word low beta transistor does not appear in claim 45, that is correct, sir.

Q. In fact, neither the word low beta transistor nor the word, "so it acts as a current limiter during initial turn-on of the lamp," that doesn't appear in claim 45, does it?

A. The words do not. But in interpreting the means plus function language, those words do appear in the patent, in the specification. And so they are part of claim 45.

Q. But they explicitly --

A. I agree that the words themselves do not appear in the claim, sir.

Q. Would you step over to the machine, Doctor.

A. Yes, sir.

(Brief interruption)

Q. I believe that the left-hand connector on the logic board is P1 and this is P2. Can you confirm that, Doctor?

A. I can't remember. If it's important, we can look at the photographs, because they have the --

THE COURT: Do you have a photograph of that?

MR. LYNCH: I think we have the photographs, your Honor. That may help.

BY MR. LYNCH:

Q. (Showing photographs.)

A. Oh, I see. Yes, that's more direct, that is correct. That is P1 on the left.

Q. Now, I call your attention over here to two yellow wires which appear to go no where and appear to have been

cut, right here; and several other wires in the region of the upper right-hand corner of P2 that appear to have been cut.

A. I can't actually see those.

Would you have the photograph of the back, sir?

A. It's actually more difficult in the photograph.

Let me point right here. (Indicating)

A. Oh, yes. Yes, sir.

Q. Here, here. (Indicating)

Do you see those cut wires?

A. I do, sir.

Q. Had you noticed those before?

A. No, sir.

Q. Do you have any idea what the configuration -- the cut wires would indicate that at some time this machine was in a different configuration, would it not?

A. This was a prototype machine, and in the process of building it -- without being present, I have no idea what those positions on the pins are for, why the wires would have been put on taken off or cut or a mistake in wiring or, I don't know, sir.

Q. You've never had an explanation of those?

A. I was not even aware that they existed, sir.

Q. Fine. Now, let's get to that matter of the operator adjustable switches on the back of the machine.

A. Yes, sir.

Q. Now, the operator adjustable switches are not switches in the same context; they involve putting these plastic connectors on these posts, correct?

A. That's it, sir. For example, this pair of yellow wires goes through the board, and there is a steering diode behind the board, and so that's a closed circuit.

And when you plug the two ends between, for example, this pin and this pin, this puts a short circuit or a connection which would be the same effect as a mechanical switch that turns on the light. It would allow current to flow through.

Q. And so the Court would understand, if we took the two yellow ones, the two yellow ones and the two red ones would be used with this series of posts, and let's say we awarded an extra game at 30,000 points.

A. All right, sir.

Q The appropriate for the first game would be the yellow ones. We would connect them on the post here and the post here, so that the crossing of those two posts would yield 30,000 points, is that correct?

A That is correct.

When the microprocessor scans those switches, it would detect that closure and would know that that is what you intended to do.

Q Now, once we did that --

A Could do that. Of course, that was not.

Q Once we did that and put the yellow ones here on the 30, if I may do that, and the other yellow one here on the 30, we would be saying, well, the 30,000 points, you have got an extra game, with this connection, correct, or you get something, an extra ball, an extra something?

A That is my understanding. I have never actually seen all the game rules of the Flicker pinball machine, but that is my understanding. That sounds reasonable.

Q Now, once you do that --

Can the Court see this?

Now, once you do that, it is the case that if you want to hook up the red wires to, say, you get two balls at a higher score, that would be what the red wires would be for, for a different award, correct?

A I do not know that that is true.

In other words, I do not know whether the Flicker game -- the game rules had the option of multiple choices there or one. I have no way of knowing that, sir.

Q There is another set of wires here, and if you look on Exhibit 52, you see that there is a suggestion that you can use two jumpers on the score, little score switch arrangement here, correct?

A Yes, sir.

Q Now, the other ones appear to be the red wires, correct?

A Yes, sir.

Q Now, if we put the red wires and wanted to select another score, we would have to select another score that was neither in the same row nor in the same column with the 30, correct?

A I do not understand why you drew that conclusion, sir.

Q How can we put this connector on the same post?

A That appears to be the physical limitation that is there, sir.

Q So one would have to, if one had to put another score-- well, let's say, well, let's make the other one 65 or 60. 60 is up here.

A Yes.

Q. So to do that, and I keep undoing the 30 -- but to do that, one would say, well, let's put one red one over here and one red one over here, correct?

A. That is what you have done, sir.

Q. Now we have got a different award at 60,000 points or 60 points or something, correct?

A. If that is allowable by the game rules, yes, sir.

Q. Now, let's look at a second jumper.

A second jumper says you can put a jumper on either 5 Ball or 3 Ball.

A. That is correct, sir.

Q. That appears to be -- it either goes in this position or that position?

A. That is correct.

Q. Now, another jumper goes either on game, ball, on, or off?

A. Yes, sir.

Q. Or in the matrix shown in the patent actually, the way it is indicated, it would go on match, replay, add-a-ball, or straight?

A. That is correct, sir.

Q. Then we also appear to have jumpers that will work on the credit and the coin operations as shown in Exhibit 52, correct?

A. That is correct, sir.

MR. LYNCH: You can return, Dr. Schoeffler.

(Brief interruption.)

BY MR. LYNCH:

Q. Looking at that, Dr. Schoeffler, we see here on the mux chart, Figure 4 of the patent, an arrangement of those thousand switches that is identical to the arrangement we saw in the back of the Flicker, correct?

A. Of the thousand switches sir?

Q. Yes, the 30 is over here.

A. I see.

Q. The 60 is here.

When we activated the 30 on the back, we put one connector on a pin here and one connector on a pin that was physically here, and that meant 30, correct?

A. That is my understanding of that connection, sir. I did not trace the wires, but I believe that is correct.

Q. We said we could not put another connector in the same column or the same row, correct?

A. Because of the physical arrangement of the plug.

Q. So physically in this part of the operator adjustable matrix, is it possible, Doctor, to have a sneak path?

A. A sneak path totally restricted to the left-hand part?

If you cannot have 2 switches in the same column --

Q. Or the same row.

A. -- or the same row, there could not be a sneak path in the left-hand part of the matrix.

Q. When we add the fact that we are also going to connect one switch in the next column marked Column A --

A. Yes, sir.

Q. -- match, replay, add-a-ball, or straight --

A. Yes, sir.

Q. -- can any combination of closed switches here give you a sneak path?

A. A sneak path totally in the left-hand part of the switch matrix --

Q. From Row A over.

A. -- cannot occur.

Q. It cannot occur in those switches, correct?

A. Totally restricted to that part of the matrix, that is correct, sir.

Q. The fact is, however, Doctor, that you testified that

there are isolation diodes in this part of the matrix, correct, the left-hand part where no sneak paths can occur?

A. Those are readily observed on the board and in the diagram here. Yes, sir, they are there.

Q. In fact, they are not diodes at each location in this matrix. They are diodes on the ends of each of those wires, correct, Doctor?

A. And that is where they should be because the diodes are placed with the switches. At a location in the matrix where there is no switch, it would hardly be appropriate to put a diode.

Q. But those diodes in this part of the matrix are in a part of the matrix where there cannot physically occur a sneak path, correct?

A. They are in the part of the matrix where a sneak path that is totally within that part of the matrix cannot occur.

Q. In the right-hand part of the matrix -- well, by adding the other 2 wires to the credits and the coins, a sneak path cannot occur either?

A. Totally in that portion of the matrix, is that your question?

Q. That is correct.

A. Then that is correct, as I have said several times.

Q. Is there any arrangement of operator switches back there that could cause a sneak path to occur?

A. The total sneak path within the left-hand part of the circuit, is that your question?

Q. Within the entire operator control portion of the circuit.

A. That is the left-hand portion of the switch matrix.

Q. That is correct.

A. As I see the switches, it is impossible to have a sneak path where the entire sneak path is in that portion of the matrix, that is correct.

Q. Is it possible for this part of the matrix to cooperate with the right-hand part of the matrix, the playfield switches, to develop a sneak path?

A. That is why the duct steering diodes are in the left-hand part of the matrix because to have a sneak path, which means you will read a switch erroneously, what you require is an L-shaped set of closed switches, and they can be in any two columns of the matrix and two rows of the matrix. So it might be possible if you did not have the diodes to have that, and since those switches on the left-hand part of the matrix, once you put those wires on, since they are operator adjustable switches, are closed all the time, if you did not have the diodes there, you would increase significantly the possibility of sneak paths.

That is why they are there and not over here.

Q. What you are saying, Doctor, in this arrangement with these items of the matrix blank, it is impossible to have a sneak path by cooperation of switches resulting from the operator adjustable switches, isn't that correct?

In this arrangement as shown in Figure 4, you can't get a L shape, can you, Doctor?

A. Sir, are you talking about the entire --

Q. I am talking about with this arrangement of switches, Doctor.

A. You are talking about the entire 4 by 16 matrix of

switches?

Q Yes, you cannot get a sneak path resultant from whatever you do on the operator-controlled switches?

A What is my understanding of this and what I am trying to testify to is that -- you selected which switch to be closed as your example?

Q 30 and 60.

A If, for example, the 30 switch were closed and when you scan this column, a sneak path might arise -- if we just at random pick a set of switches in this part of the matrix, if one had this closed, this closed, and this closed (indicating) and did not have diodes, then it would be possible to have a sneak path to read at here (indicating), but with the --

Q A sneak path --

A I must think about my answer to see that I am answering correctly.

(Brief interruption.)

BY THE WITNESS:

A Thank you for waiting. Would you now repeat the precise question again?

BY MR. LYNCH:

Q Just so we understand what a sneak path is, Doctor, if we have three switches closed, some of them presumably stuck, let's say switch 13 on Exhibit 13-E is a valid closure, correct?

A. Yes, sir.

Q. Now, the way these go is that the vertical lines are not attached to the horizontal lines at their cross points, right?

A. That is correct.

Q. So if this is closed, current could go like this (indicating). If 12 were stuck and if 22 were then closed, that would be a sneak path if 12 were stuck, correct?

A. We are reading which column in your example, sir?

Q. Let's say we are reading the column that has 13 and 23 in it.

A. All right, and 13 is closed.

Q. 13 is closed.

A. But 23 is open?

Q. 23 is open.

A. In that case, if there were no diodes there, we would read that the sneak path is present, and hence, we would erroneously read 23 as closed because it sneaks around and looks like it is connected to ground, that is correct, sir.

Q. The reason the diode helps is because I did this yellow matter, and as I came to 22, I couldn't go across that diode, correct? The diode would prevent me from conducting or from closing switch 22, from passing in that direction, correct?

A. The result of what you said is correct. You drew the whole sequence backwards, however.

Q. Undoubtedly I did.

A. But that is correct, that is a sneak path if there are no diodes.

Q. The fact of the matter is to get a sneak path, you need a closure of switches in an L-shape?

A. That is correct, sir.

Q. A connected L-shape, correct?

A. Well, the horizontal part of the L must be in the same row and the vertical part of the L must be in the same column. They can be anywhere in the matrix; you are correct, sir.

Q. Can any arrangement of these switches result in a sneak path?

A. In the entire matrix?

Q. Yes.

A. As I look at it quickly here, I believe it can.

Q. How?

A. I believe what it would require would be reading a column here that has the diode in it and then a pair of switches over here so that the L would cause that.

Q. But then that could be cured if there were diodes on the playfield switches, correct?

A. Absolutely.

Q. The sneak paths which could result from two simultaneous switch closures and a stuck switch on the playfield of Flicker as a result of 3 balls on the playfield would similarly be solved by diodes in the playfield switch matrix of Flicker, correct?

A. As disclosed in the specification, that is the way to

solve that problem, that is correct, sir.

Q. So doesn't it appear, Doctor, that if one were to use isolation diodes on the Flicker and if one were to attempt to use them to prevent sneak paths, then indeed they should have been used on the playfield of Flicker?

A. Exactly why Frederiksen did not put them on the playfield of Flicker and why he disclosed them in the specification, I, of course, have no way of knowing; but if they can occur and if they had been put on the playfield, then the possibility of a sneak path would be eliminated.

Q. Your testimony was that, at Page 1666, "When sneak paths are present which would permit you to read a switch closed which was not closed, the diodes are essential."

Do you agree with that?

A. They are essential in order to avoid the sneak path, that is correct, sir.

Q. You just indicated "essential." Thank you, Doctor.

Only one more matter.

You looked at the back of the Flicker game and I have had blown up Exhibit 52.

Now, when you testified about this previously, I would like to explain to the Court briefly what this means. This is an arrangement, is it not, Doctor, where if I were to draw a box (indicating) around the components, everything within the green dotted outline on the large Exhibit 52 would

be on the mother board?

A. That is the convention for doing that, and so if that diagram is accurate, it would be that way.

Q Out here where it says this goes to the playfield and this goes to the playfield and over here from P2 and P1, we have connections to the logic board or the IC components, the integrated circuits components, in the microprocessor, correct?

A This diagram at the bottom is certainly labeled consistent with that.

The upper left-hand corner, as I testified yesterday, is not labeled consistent with that. But since I did not trace the wires, I do not know what the situation is up there. So it is hard to interpret that.

Q According to this drawing, from the playfield we come on to the mother board from various playfield switches, correct?

A That is what the diagram shows, sir.

Q It indicates that these switches should go to connector P2, and let me mark the switches as A -- strike that -- I am going to mark them improperly as A -- inputs 2 through 8 go to inputs, it appears, 2 through 8 at P2, correct?

A That is what the diagram shows, sir.

Q The diagram then indicates that the signal comes off of the IC board and come through P2, is processed variously on the mother board, and exits the mother board, P4, to the playfield, correct?

A This is where the diagram is ambiguous, so you cannot draw that conclusion. It is inconsistent.

The arrows on the lines indicate that is the direction of a signal, but the labeling of the lines are inconsistent with that.

So I do not know what happens.

There at the playfield end, those are consistent with the game.

The only ambiguity in this diagram is whoever drew it-- the date on this is December, long after the fact. What happened up there and what the real connections are up there is not clear from what is on this diagram. That is all I can say.

Q The diagram indicates right now that a series of inputs came off the logic board at mux zero -- I mean, at connections 2 through 8 of pin 2 and go off at pins 2 through 8 of pin 4, correct?

A But that is inconsistent with the labels. Mux zero are on this board, and so they either came off the other board or they didn't, but that is totally inconsistent. Usually, you can draw any conclusion you would like from what is on this diagram.

Q Let me give you a supposed, Doctor.

A All right.

Q Suppose there were two synchronous decoders.

A Two synchronous decoders?

Q Both generating mux signals.

A What do you mean by a synchronous decoder, sir?

Q That they are operating in synchrony.

A Oh, in parallel?

Q Yes.

A Yes, sir.

Q Then the switch matrix would be driven from the position I have indicated as A on P2, correct?

A It could --

With your supposition, you are assuming the second synchronous decoder is on the CPU board with the first one.

Q Well, that is where it would logically be, wouldn't it?

A That is correct. I am just checking your supposition and then those would go to the switch line, that is correct, sir.

Q Now, that would indicate then that the lamps and digits were being driven from the collector of the transistor, which comes off pin 1 of connector P1, correct?

A And labeld mux zero to F as are the ones up here.

Q Labelled Mux Drive.

A The signals from the CPU board are labeled Mux Drive.

See, and with your supposition now, that's still inconsistent.

If there were two running in parallel for some reason, and they brought them through twice, it would be more consistent to have labeled mux drive up on the upper left also.

Q Except it is true that the components being driven from P2 require more driving than do the switches being driven from -- strike that.

It is true that the lamps and digits require more driving than do the switches, correct?

A That's not quite correct, sir.

By driving, we mean the signal from the decoder. That's a very light current signal.

What is needed is power to light the lamps. And that's supplied actually from this slow turn-on transistor labeled 2N6043 in the left-hand corner of the diagram.

Q One last question, Doctor: Did you notice as to whether or not there are wires that jump from the collector of this 2N6043 connector down in the right-hand corner, and jump up to the area of P2 on the mother board?

A I did not trace the wires, sir.

What I observed in the computer program is that

when a column is selected there is only one place in that computer program that a column is selected, and hence the column of switches, digits and lamps are all enabled at exactly the same time.

MR. LYNCH: I don't have any further questions, your Honor.

CROSS EXAMINATION

BY MR. GOLDENBERG:

Q Doctor, do you know how that Flicker game works?

A I've studied the game, sir, and I believe I understand the operation of the game.

Q What have you studied, sir?

A I've studied the schematics of the Flicker game, and I have studied the program submitted which is part of the patent.

I've observed the game itself, and I listened to Frederiksen's testimony.

Q Now, one of the schematics you studied is this exhibit Mr. Lynch was just asking you about. Isn't that correct?

A That is correct, sir.

Q And that's ambiguous.

A The exact way the wiring is laid out is ambiguous because of the labeling in the upper left-hand corner.

That has nothing to do with my understanding, however, of the operation of the game, sir.

Q Okay. So you start with an ambiguous drawing, but you understand that.

And then we go to a Flicker game where you haven't checked the circuits. Do you understand that?

A I stated that I did not trace the wires on all those boards, yes, sir.

Q And then you made mention a moment ago of the computer program, and you studied that. Do I understand that, sir?

A That is correct, sir.

Q And we know now, all of us, that that computer program is inoperative. We know that, don't we?

A The computer program that was dumped from the PROMs in the Flicker is a debugged version of the program that was submitted to the Patent Office and is part of the patent.

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patent

Q. Well, the computer program you had reference to was Plaintiff's Exhibit 30 and Plaintiff's Exhibit 436. Isn't that correct?

A. That is correct, sir.

Q. And so that's the program listing you studied.

A. That is correct, sir.

Q. So based on an ambiguous drawing, complicated or relatively complicated piece of electronic equipment, circuits you've never checked, and an inoperative computer program listing, you know how that game works over there. Is that your testimony?

A. I studied the Flicker game in order to be able to read the claims in suit on that game.

And the claims in suit refer to matrix multiplexing and they refer to the other related things which I've testified to at length, and the use of those schematics, the use of these programs that I indicated I used, and my examination of the Flicker are sufficient to determine that those claims do indeed read on Flicker.

I never testified as to the exact sequence in which hardware was put together or wired. I had no part in that. I was not around. I had no direct knowledge of that.

And there was no testimony that I ever saw that was related to that.

So in reading the claims, the materials I

looked at are sufficient to understand the operation of that game, the single matrix and all of the other related things.

Q. Sir, could you answer my question? Is it your testimony that, based on ambiguous drawings, electronic circuitry that you have never checked, and your understanding of an inoperative computer program, you know how that Flicker game works?

A. Which of my testimony --

Q. Could you answer my --

A. -- are you referring to?

Q. Sir, could you answer my question? If you want to give an explanation, please do that. But answer my question yes or no.

A. May I ask for a clarification?

You said my testimony --

Q. I'm asking --

A. -- and I don't know specifically what testimony you gave, because I never testified --

Q. Let's have your testimony, then.

Do you understand how that Flicker game works?

A. I believe I understand how the Flicker game works, sir.

Q. All right, sir. Now, what -- and am I correct that the basis of your understanding is your study of ambiguous drawings, no study of the machine itself, and a study of an inoperative computer program? Am I correct?

A. No, sir, not quite. Not precisely correct.

ect.

Q All right, sir. What else?

A You said no study of the machine itself.

I looked at the machine, I played the machine, and saw the way it operated. I did not trace the circuits in the diagram.

By looking at the computer program and observing the structure of the computer program the way the columns are enabled, the sequence in which lamps are lit and --enabled and lit, when switches are read, et cetera, I came to an understanding of the operation of the Flicker game which has not changed based upon any further study of the program that is actually in the Flicker and is not affected by this ambiguity in the upper left-hand corner.

Q Well, can you and I agree, sir, that the computer program listings that you have studied, Plaintiff's Exhibit 30 and 436, are inoperative and are not -- do not represent the computer program in the Flicker game?

A No, we cannot, because of the last clause that you added to your question.

The difference -- let me rephrase it.

The program that is in the Flicker PROM presumably right now -- and that program is the same program; the only difference is a few changes in instructions for debugging purposes, and one does not conventionally in the industry, when we are talking about programs, mean that those are different.

There are instructions that are different, but they do not change the structure, they do not change the operation of that game in any way that is relevant to the claims of this patent or the disclosures in the patent.

Q All right. Let's put computer talk aside and let's try to talk English.

Exhibits 30 and 436, does that represent the computer program loaded into that Flicker game?

A The structure, the sequencing, and everything else in the exhibit is the same as what is in the PROMs right now.

There are differences. The bugs that were in that program have been removed since this.

But they are not major, they are not structural, and they do not affect anything that I have been able to determine that is at all significant in the operation of the pinball game itself.

Q All right, sir. I think we're in agreement. You've said they were different.

A I did not say that the programs were different. I said there was instruction change in the program in the ROM.

Q Aren't there omissions in the exhibits, in Exhibits 30 and 436?

A Omissions, sir?

Q Yes, sir.

A In the program that was submitted to the patent office

is the symbolic version of the program.

Q Can you answer my question, sir? Aren't there omissions?

A I'm trying to answer the question, sir.

The program that was submitted to the patent office is the symbolic version of the program.

What appears in the ROMs in the Flicker board is of course what is called the object code version. And in the process of creating the object code version, the patches or changes or bugs were added to it.

And so if you count instructions and match up instructions, although most of them are the same, there are additional things in the ROM that do not appear in the symbolic program. That is a normal part of patching or debugging a computer program.

Q Sir, don't you recall Mr. Frederiksen's testimony in this case that Exhibits 30 and 436 represented -- I am sorry -- was a listing of what was in the ROMs of the Flicker game?

A. I do not recall the exact words he used, which are relevant the way you have worded your question, sir.

I thought -- my recollection of what he said is that that is the program that is in the Flicker.

Q. Well, let me read this to you, and this is from Page 253 of the transcript on January 4.

"Q. I show you Plaintiff's Exhibit 30. Can you identify it?

"A. Yes. This is the program essentially as it existed at the time of the demonstration for the Bally Flicker.

"Q. Is this the program that you submitted as part of your original patent application? Can you tell us that?

"A. I believe so."

Now, the fact is it is not the program.

A. As he said, it is essentially the program.

Q. It is not identical, is it not?

A. There have been bugs removed in that program, and so there are instructions that are different, that is correct, sir.

Q. All right, sir, let's go on to another topic.

I recall in your testimony earlier in this proceeding you made reference to an experience you had consulting or working for Ford Motor Company.

Do you recall that, sir?

A. Yes, sir.

Q. When was that?

A. My involvement with Ford, as best I can recall, without going back and checking precise dates, was probably '71 or '72, and that went on actually to the present day.

Q. Now, do I understand correctly that you were part of a team that was exploring putting microprocessors in automobiles, is that correct?

A. I was consulting for the team and then doing research in the University funded by that team.

More than microprocessors, that project started out using -- because microprocessors were not available when the project started. They were actually looking and were driving cars and installing minicomputers, larger size computers, to do that.

As the project evolved, it was replaced with a microprocessor, which is essentially what is in the Ford automobile today.

Q. You consulted with that team?

A. That is correct, sir.

Q. I think you told us that there were persons of educational

and professional attainment, such as yourself, men with graduate degrees, and a great number of them, and many, many dollars were spent?

A. That project was carried out in the Ford Motor Research labs where almost all the people in the labs are of that level, sir.

Q. Did I understand correctly that what you were trying to do and telling us about that was to contrast it with Mr. Frederiksen's ability or achievement of putting a microprocessor in a pinball game, is that correct?

A. One of the major reasons I had brought up that subject, sir, was because of the discussion of the constraint that Frederiksen mentioned of working with the components in the pinball game as they exist that were not -- that we were unable to change, because in that project, there was no limit to what could be modified in the engine, the engine design, or the controls of the engine, in order to make that real time system functional.

So there were far fewer constraints and certainly no economic constraints at that stage. It was still a research project at that stage.

So whether it was feasible or not was incidental to the project until a later stage it moved into production.

Q Now what was this computer, of any size, whether it be a microprocessor or a mini computer, what was it going to do in an automobile?

A In the Ford automobile?

Q Yes.

A I am not a mechanical engineer, so you will have to accept my memory of what it is.

The computer on a periodic basis was going to read the pressure as it existed somewhere in the engine, which then would vary whether you were driving the car in the mountains or down in the desert, and it affected the way the engine was working.

It was measuring, as I recall, at least a couple of temperatures somewhere in the engine.

It was measuring the speed of the engine.

As I recall, it was measuring the actual speed of the car, counting as the wheels rotated, and the driver's position on the gas pedal.

The computer was then supposed to do two main functions in its control. One was to manipulate what was called the exhaust gas recirculation valve. That is the device that the EPA agency requires on cars to prevent pollution. The usual valve is not adjustable at all, but a special one was put on the engine that the computer could adjust.

Then it was going to also adjust exactly where

in the cycle as the piston moves up and down that the spark plugs would fire, so that the car would get the best possible response in the sense of driveability without failing the emission test.

Those were the major objectives. In addition, the computer was responsible for error recovery; namely, if you were driving the car and the computer failed, the car was constrained, as I recall, to be driveable but not pollute, and that produced all kinds of problems, which required custom computerr chips to be designed.

It was a very complex real time system.

Q. Very complex real time system.

If I have kept up with you correctly, I have it measuring or ascertaining pressure, two temperatures, speed of the car, speed of the engine, and the driver's position on the gas pedal, am I correct, sir?

A. I mentioned those. I don't know if there were others.

Q. Might have been others.

A. I can't remember, but those were the essential ones, sir.

Q. So that is at least six input variables, right?

A. That is correct, sir.

Q. It was going to control two outputs, the spark plug and this exhaust gas recirculation valve, right?

A. That is my recollection, sir.

Q There were problems doing that, isn't that right?

A Yes, sir, because the car had to operate even when the engine was running very fast.

Q How do you contrast that kind of effort, those kinds of problems, when all you are trying to do in a pinball game is determine whether or not a switch is closed and light a light or register a score?

A If all I had to do in a pinball game was sit there and watch the switches and determine when they closed and when I found one go off and light a light, none of us would be here. That is not the situation in that pinball game at all.

That pinball game is a very complex real time system. In that struc -- well, we have covered it up, but in that matrix, there are 64 switches that have to be scanned and where the closure has to be detected in time to respond, while at the same time keeping all the lamps lit at the appropriate time, the digits going, and the score, doing the calculations in a microprocessor, which in 1974 was absolutely nothing in comparison of power to what was available to a Ford Motor research team in a mini computer, and it had to be done at low cost in an environment where there was a tremendous amount of noise.

That was a difficult problem in that year and especially for the typical digital logic designer who would be working in this environment.

Remember, the digital logic designers are not pinball experts, and as a consequence, one had to look to this kind of an engineer. He had to learn about pinball games or work with a pinball engineer. He was accustomed to solving all of his problems in hardware, had no concept of this scheme that we are talking about, namely, this cooperation between hardware noise prevention and this software noise immunity.

That was a foreign concept to the engineers of that era, and they were not accustomed to doing that. Those people had to deduce for this pinball game that with the economic constraints, they could do reasonable and low cost hardware prevention. What they could not do with hardware noise prevention, they had to do in the software to make that pinball machine operable, using the words of the patent.

It is my opinion -- I have been working on real time systems since 1960 -- that that is a complex problem and for this industry and the people who were working in it in 1974, '75, that was a feat to produce that design, and the particular design that emerged from this by Frederiksen is what I termed earlier and which I will state again, because I believe it, it is an elegant and lasting design and was a very creative contribution.

Q Now technically, all that had to be done -- and you can answer yes or no to this. Put aside the economic contraints. Put those aside. They exist in every industry.

We can agree on that, can't we? Ford Motor Company, with all of its resources, nevertheless had to come up with an economic system, did it not?

A. Not in the sense that you are using the word "economic."

Ford Motor's economics come from producing five or six million cars per year and that divides the cost by quite a large number; but I agree with the general statement that all projects, no matter how large or small, have some economic constraints, sir.

Q. Now, isn't it the fact that in 1973 microcomputers had been installed and in use on any number of real time systems?

A. In that era I was working very heavily in the process control field, both in a research environment at Case Western Reserve University, the industrial sponsored program, and through consulting, and that industry had been using mini computers with data acquisition systems that were hardware oriented that were extremely expensive, more expensive than the computer by far, to solve the noise problems since computer control was introduced in 1961.

At that time it was not considered feasible to use the microprocessor to replace what is called the front end to the computer because of severity of the noise problem. They

were not being widely used in all of the industries I talked about. It was only later when the entire structure of process control systems changed to module distributed systems and the modules changed in where they were placed that microprocessors were introduced in the systems that I am familiar with.

Q. Sir, I ask you once again is it not the fact that in 1973, before Mr. Frederiksen completed his work, perhaps even started his work, microprocessors were being used in various industrial applications in real time situations?

A. I personally do not know of any control product in '73 that I would consider a working product that involved a microprocessor that had previously, for example, been done by mini computers. The only exceptions were the industries like the aerospace industry, where there are different constraints and different kinds of people who were probably using microprocessors and were part of the development of the microprocessor art, sir.

Q. Sir, you confuse me. Is your answer to my question yes or no?

A. My answer to your question was I am not aware of an industrial process control product in 1973 that was replacing the corresponding work that had been done up through those years where noise was any kind of a significant problem.

Q You are saying --

THE COURT: I share Mr. Goldenberg's confusion. I do not know whether you are saying yes or no. I take it you are saying no.

THE WITNESS: I think I am saying no.

THE COURT: All right. The answer is no.

THE WITNESS: There may be some. I just don't know of them.

THE COURT: As far as he knows, the answer is no.

MR. GOLDENBERG: All right.

BY MR. GOLDENBERG:

Q Let me show you a document which we have marked as Exhibit 21-A.

MR. SCHNAYER: Excuse me, Mr. Goldenberg. I do not think we have a copy of that.

MR. GOLDENBERG: I think you do. You were supplied it yesterday. It is the Intel microcomputer, April 1973.

MR. SCHNAYER: Your Honor, I would like to make an objection at this point.

We received recently a copy of an updated 282 notice. If your Honor recalls, under Section 282, defendants are required 30 days prior to trial to list the prior art that they are relying on at trial.

They, in fact, updated that maybe a couple of times even before the trial in that 30-day period.

We received yesterday afternoon a stack of new prior art that they are claiming they are going to be using at the trial. Apparently this is one of them. We have not received a marked copy of an exhibit yet.

We have not had a chance to even look at that material, and I object to its use completely at this time.

If they are going to rely on further prior art, according to the scope and spirit of Section 282, we would have to be able to go back and have the ability to, if we need to, amend our claims and recall all of our witnesses.

This does not give us a proper chance to adequately prepare for trial. This is a statutory requirement which is not being complied with at this time.

I have not even gone through all of their documents. I have not had the occasion to. It is a huge stack.

THE COURT: Mr. Goldenberg.

MR. GOLDENBERG: Your Honor, this is one document from this huge stack, which is not all that huge, to start with. It was supplied to them yesterday with an exhibit tab on it.

It is, as you see, a simple brochure. We have made the point earlier in this proceedings numerous times that the microprocessor, at the time that we were talking about, was finding a lot of applications. We were not aware that Dr. Schoeffler or anybody else testifying in this case

was going to take the position we believe to be incredible; namely, that that was not the case.

THE COURT: Well, you are not relying on this as prior art in the sense that it anticipated the invention?

MR. GOLDENBERG: No, sir.

THE COURT: This is general background information.

MR. GOLDENBERG: This is general background information.

THE COURT: It is also information that goes to the question of his expertise --

MR. GOLDENBERG: Surely.

THE COURT: -- it seems to me.

Obviously, this is a person who should have been familiar with everything that has been going on, and whether or not it specifically anticipates the invention in question, the objection is overruled.

MR. SCHNAYER: Can we have a copy of that? We got it late last night.

MR. GOLDENBERG: We supplied you one yesterday. I invite you to stand beside the witness as he turns through it, as I have to do, because this is all --

THE COURT: That will not be necessary. Proceed.

MR. GOLDENBERG: Yes.

BY MR. GOLDENBERG:

Q Dr. Schoeffler, I show you this document, which is Defendants' EXhibit 21-A.

Have you read the cover of the document, sir?

A I read the title.

Q Intel is the company, is it not, that was supplying the microcomputer used by Mr. Frederiksen in the Flicker game?

A. That is correct, sir.

Q. Is your understanding the same as mine, that whatever he did was done essentially in 1974, is that correct?

A. That is my understanding, sir.

Q. The date on this publication is April 1973, isn't that correct?

A. That is what the cover says, sir.

Q. Now, can you agree with me that after turning through that to your satisfaction that that shows in April of 1973, not only the microprocessor, but, very specifically, the Intel microprocessor was being applied, had been applied, in any number of applications?

A. The microprocessor, of course, in 1973 -- excuse me -- as I testified earlier on direct examination was being used in 1973 in calculators and calculator-like applications.

The ones I see here including instrumentation fall into that category, in my opinion.

Q. All right, sir.

A. So I am looking at this page, which is unnumbered, and a desk top computer and a blood analyzer fall into that category.

Q. Let me ask you a question, if I may.

A. Yes, sir.

Q. Turn to the unnumbered page, which is "Intel Microcomputer Works in Com Star's Control Computer."

Is that a desk top calculator application?

A. I will read the column that is written here.

Q. Sure, read it before you give your answer.

A. Thank you.

THE COURT: Which one is it? Excuse me.

THE WITNESS: This one, your Honor, "Com Star Process Control Computer."

THE COURT: Yes.

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(Brief interruption)

BY THE WITNESS:

A I've read this, sir.

BY MR. GOLDENBERG:

Q My question, sir: is that a desktop calculator application?

A No, sir. From the wording in this column it appears that this is a replacement digital logic application.

Q And it's an industrial process control, is it not?

A The industrial processes used lots of logic for sequencing things and the like.

And this is, looks like a replacement for, as they indicate here in the middle paragraph, racks of counters, timers and relays.

And in the early 70s that's what the Intel and the other microcomputer vendors were pushing the microprocessors for. That is, take discrete logic out of which we design control systems, and replace it by a program to do the same thing.

And so this is a control application, that is correct, sir.

This is not -- the way I read -- there is very limited information here, of course, and so it would have to be investigated before anything certain could be said -- but this does not fall into the category of what we normally

think of as a real time process control computer-based application.

In contrast, it is what we would call a digital logic replacement, sir.

Q All right, sir. Let's deal with that.

Do I misunderstand that this is a bottle loading machine? Right?

A Yes, sir.

What it says specifically here is, "It tells the machine how to load bottles of different sizes."

So I imagine -- and I have to conjecture based on what I had seen at that time -- that when --

Q Let me ask you a question, sir: and you say that's not real time?

A What I said, sir, was that this kind of an application of the computer does not fall into the category of what we normally term, in those years, to be real time process control kinds of systems where it was doing digital logic.

The difference would be primarily, this thing would be sitting there keeping track of time, reading the signals and counting, and periodically outputting a signal to the device.

Q And it is indifferent as to whether the bottle it wants to be loaded is under the filling spout or 20 feet down the conveyor line. Is that what you're telling me?

A No, sir.

I would have to look at the actual implementation of this one to be specific. It could have been organized in a number of ways.

It could be that the hardware on the machine is actually carrying out the application, and the computer is calculating the commands.

Or, if it were closer to real control like the computer in the car, if it was actually doing the commands on a moment-by-moment basis.

There's not enough information there to be definitive about how complex it is, how difficult, or things of this nature.

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Q. I understand, sir.

Now in that Intel brochure there are a number of devices which are real time uses of the Intel microprocessor in 1973, are there not?

A. The desk top calculator or desk top computer I don't put in that category any more than I put a calculator.

The word real time, when it was used in this era, all right, always carried the connotation of many things going on in parallel, simultaneity of events we used many times to describe what was going on in there, in a noisy environment.

That's not true of the desk top computer. It's probably not true of the blood analyzer.

Namely, the way a blood analyzer normally works, just like a calculator: One takes a measurement of some kind and then goes through a calculation in order to eventually print out or display the contents of the blood. That's an instrumentation kind of application.

And it is not like the pinball machine, that is, while it's doing the calculation it's got to go out and light lights and sequence things.

And so I just don't use that word to describe it. And I don't believe that most people working in the control field in 1973 would call that a real time system.

A business machine has never been and today is still not considered a real time system. I'm referring to the next

page.

Q. Can I ask a question, sir?

A. Yes, sir.

Q. I'm a business man. Let's take one of these devices here: The desk top computer. Is that real time?

A. I've just said that I would not call that real time because it would just muddy the use of that word, it would be a vague use of that word, sir.

Q. And would it be your testimony therefore that someone using a desk top computer can, using the keyboard, punch in some numbers and then what does he do? Go out to lunch and then come back after lunch and see what happened.

A. That's not the essence of my use of the word real time.

The essence of the word real time, when you're talking control, is carrying out events with prescribed response times, simultaneity of events, lots of noise.

None of those are present in the desk top computer. That's a low noise environment. There is no hard constraint on the response time.

In fact, if you punch in some numbers, as you describe it, and have it do a calculation, the answer is, you wait for that calculation, whether it does it in a tenth of a second, one second or an hour, you have no choice.

And so people in 1973 and today would not call a desk top computer a real time computer control system, sir.

Q. Do you recognize, sir, that there are some who might disagree with you?

A. I accept that there may be many that would disagree with me, sir.

Q. All right. Now, let's talk about noise.

Can you agree with me that a bottle filling machine associated with conveyors, electric motors, and switches and heavy electrical currents, can you agree with me, sir, that that's a rather noisy electrical environment?

A. Without seeing that factory, I'm sure that it probably is, sir.

Q. Much noisier in fact that in a pinball environment, is it not?

A. Not necessarily, sir.

The noise depends on proximity of things. In other words, the noise we were worried about under that playfield in the pinball machine is all constrained in there closely where these things have to be.

In the factory, if it was one of these very dense factories with motors and relays and all these things all packed in, it could be horrible, some of them are terrible. They could be separated.

The severity in the environment depends on the size of the current, how rapidly things are changing, and the like.

If this is an old-fashioned conveyor system, the

only electric motor kind of things were the running of those motors, and in general those have not proved to be major sources of problem.

Not like the motors you would see on a steel mill rolling line where you're trying to control steel and it's jerking back and forth and you're starting and stopping and there are very large currents going.

So without looking at the environment, it's very hard to compare them.

But because it's industrial size does not necessarily make it any worse or any better than the pinball game.

1,1

Q But there is electrical noise, is there not, sir?

A Absolutely I would expect electrical noise, and in the design of the control system, a competent engineer would have to take that into account very, very carefully.

Q In 1973 competent electrical engineers knew a whole repertoire of devices to deal with noise, didn't they?

A Noise has been a problem forever in electrical engineering, and in 1973 the typical digital logic designer would have been concerned with noise, most especially, however, limited to hardware techniques for eliminating the noise, not software techniques for eliminating the noise.

That is where the lack was, and that is what appears in this invention to give this combination of hardware and software cooperating to carry out the application. That is what was lacking. That was not generally available in '73 and not common knowledge, not taught in the schools even at that time, just beginning.

Q So I think we are in agreement that with respect to hardware solutions to noise, great numbers of them were known in 1973 and resorted to by digital designers as they designed equipment, isn't that correct?

A That is correct, sir.

Q So that what we are left with are the software solutions to noise as being somewhat unique on the part of Mr. Frederiksen, is that correct?

1,2

A. Oh, no, that is not correct, sir. I did not testify to that at all.

What I said was it was the combination of hardware and software that was so unique in the invention.

Q. The combination, all right, sir.

Well, I am not going to go through all that again, but just tell me as quickly as you can the software solutions to noise. Lag sensing I recall was one of them.

A. You want --

THE COURT: We don't want to repeat --

MR. GOLDENBERG: No, no, no.

THE COURT: I recall we spent days --

MR. GOLDENBERG: I will withdraw that, Judge. I will withdraw that.

BY MR. GOLDENBERG:

Q. All right, sir, there is one thing. Do you have a copy of the patent up there, the '441 patent?

A. Yes, sir, I do.

Q. Can you point out to me anywhere in the patent where software noise techniques are discussed?

A. In the computer program, sir, that is part of the patent.

Q. In the computer program?

A. Recall that in all the claims and in the specification, it refers to microprocessors, programs, program memory, use of sub-routines, and all of the other things associated with

programs to make it operable.

That "means plus function" language, when we look into the specification, we find noise, real time all over the place, and in the specific ones disclosed by Frederiksen, as used in the Flicker, those specific ones happen to be in the computer program.

Q. Can you point out to me in the English text of the patent where software noise solution techniques are discussed?

A. In the computer program, which is part of the patent, in English, in comments, there are several, and I will read them to you, sir.

On the first page of the program, inside the subroutine that is labelled "Switch," you see the English statement, "Ignore the noisy switch."

itch.

Q All right, sir, perhaps we can shorten this.

A All right.

Q I understand it is your position that in the program listing there are a number of things which deal with software solution to noise, is that correct?

A That are displayed both in the listing and the comments that go with the listing, sir.

Q Now I direct your attention to column 3, line 21 of the patent.

MR. LYNCH: May it please the Court, your Honor (indicating).

THE COURT: Oh, fine. Thank you. I have it somewhere here.

Line 3?

MR. GOLDENBERG: Line 21.

THE COURT: Column what?

MR. GOLDENBERG: Line 21, column 3.

BY MR. GOLDENBERG:

Q Can you read, sir, out loud the paragraph starting on that line?

A You are asking me to read it out loud, sir?

Q Yes, sir, I am.

A "The invention thus provides a convenient means for maintaining a generalized logical control for a game apparatus, employing the advantages of a small memory

system which can, of course, be readily adapted to a conventional software control of the game response, in accordance with a relatively fixed field memory."

Q Is it unreasonable, sir, to conclude from that that the software that Mr. Frederiksen is talking about there is conventional?

A No, sir, I don't believe that is the use of the word conventional there.

I believe I would interpret that use of the word conventional there not to mean the particular program or organization that he had, but conventional in that software running in computers can control and manipulate information, and it is equivalent to saying that it is well known that software can do it.

I do not believe he is referring to his own program at that point.

THE COURT: In your view Frederiksen's program was definitely not conventional?

THE WITNESS: That is correct, sir. The organization of that program had to be such that it could work just properly with the hardware to do it, and none of the programs we saw, for example, in the 4004 microprocessor manual or anything like that, taught any such structure for real time programs.

BY MR. GOLDENBERG:

Q. Now, sir, were you in Court when Mr. Frederiksen testified that this large drawing here, Exhibit 13-E, was an accurate representation of the system of the '441 patent?

A. I do not believe I was present that day, but I read his testimony, sir.

Q. Do you have a view as to whether or not that is an accurate representation of the system?

Let me change the word here.

Have you ever heard the word, architecture, in connection with digital logic and computer system?

A. Yes, sir.

Q. Would you accept the characterization of this as representing the architecture of the '441 patent?

A. The word, architecture, when it is used in conjunction with the applications like this or computer systems is referring to the organization of the systems, and it is usually displayed much the way this diagram is displayed, as a block diagram. But it is always qualified as to the purpose for drawing the block diagram; namely, the purpose of a block diagram is to give insight into a complicated system to some aspect of it under discussion.

So, for example, if what you are concerned about in the discussion of the Flicker is the way these columns are synchronized in time and that line there then that

comes out from the block labeled memory and then goes up to the 1-of-16 decoder and down to the 1-of-16 decoder and so on, that kind of consideration; then that can be discussed and given insight into that. And in that sense, this is --

This is accurate. I did not see the one line there, for that aspect of it.

Where it is not an accurate representation of the system is if we were discussing things like noise prevention and noise immunity, the organization or structure of the real time system. There the block diagram does not help or give insight into that aspect.

Q. Because it does not have the circuit details that you would talk about in connection with that kind of thing?

A. Those things are not just circuit details. The noise prevention and noise immunity combination is what makes the patent work.

Q. Sir, --

A. And if I were discussing that, this would be worthless.

Q. Sir, I meant nothing derogatory by calling them details. I truly did not.

Those are circuit, specific circuit elements. They are not shown in this drawing. Isn't that what you are telling me?

A. They are not shown, nor is there interaction with the software in order to make this thing work properly shown on

that diagram, sir.

So it is inadequate for that point of view. That is all I am saying.

Q But it shows the basic system architecture?

A It shows the matrix and, most importantly, it shows the synchronization of the lamps, switches, and decoders, so that the -- some of the noise immunity techniques would be possible, sir. That is correct.

Q All right, sir.

Now, can you agree that on the right-hand side of this drawing and the lower half of the right-hand side, we show the single matrix shown in the '441 patent, is that correct?

A I would interpret that as representing that, yes, sir.

Q The lamps, the switches, and the numeric displays all connected into the single matrix?

A That is correct, sir.

Q Can you turn to the patent in Column 2?

A I have found Column 2, sir.

Q Now, I ask you, sir, in reading -- if you start in Column 2 at line 43 and continue down to line 48, let me ask you to read that.

A Starting with the word, "generally"?

Q "Generally," and then read down to the line 48. Read that out loud, sir.

A "Generally, in accordance with the present invention, the playing field is constructed in accordance with the usual construction to develop a

plurality of lanes, response target devices, and flipper elements. The several elements activate switch means and establish signals to a common matrixing or multiplexing circuit."

Q Now, doesn't that say, sir, that in accordance with the invention of the '441 patent, there is a common matrix circuit for those elements?

A That particular statement does, but earlier in Column 2 is a previous reference, which does not preclude the multiple matrices, and it is evident from the claims later on that the meaning of those was to claim the multiple matrices.

Q What earlier statement do you have reference to, sir?

A I will have to find it, sir. Excuse me.

(Brief interruption)

BY THE WITNESS:

A It is the section that begins at line 25.

BY MR. GOLDENBERG:

Q Is this in Column 2 also?

A It's also in Column 2, which is previous to the section you asked me to read.

And there it says:

"Generally in accordance with the present invention the display means, the element activated the response means, and the interlocking control means are arranged into sequentially activated element groups and connected through a matrixing or multiplexing means to a program logic means such as a microprocessor," et cetera.

It does not say that those had to be in a common matrix, and clearly describes the situation where the microprocessors were controlling several matrices, either with switches in one, lamps in another and digits in another, or some other combination. It is not excluded there.

The specific embodiment which is then described at length in the patent clearly and consistently is referring to the single matrix as in Flicker.

Q And you don't see that paragraph in Column 2, "Summary of the present invention," as getting from the broad to the more specific as the inventor describes his invention in greater detail?

A I'm afraid your question is not clear to me, sir.

Q Let me withdraw it, then.

Isn't it a fair reading of that paragraph to simply appreciate that what's being done there, that the inventor, after making some general statement, is simply, as he progresses through the paragraph, is now telling you more specifically as you get toward the bottom of the paragraph as to what his invention is?

And he finally tells you, he finally tells you that the invention is putting these elements in a common matrix.

A I don't agree with that, sir.

Q Okay.

A I read this as being what he's -- most of this patent, where he says, "Let's get down to the specific embodiment," over and over again.

But I believe that this is part of the specification, and this is totally consistent with the claims which lead to the multiple matrices, sir.

Q Can you agree with me, sir, that in Column 2 in the part from which you just read, in line 28, it talks about a matrixing means, doesn't it?

A Yes, but when one talks about a matrixing means, this is a means to carry out a function. And so separate matrices are ways to carry out those functions, and they are described then throughout the patent.

So when you just read it all, I think it becomes very clear precisely what is meant here, sir.

Q All right, sir.

MR. SCHNAYER: Excuse me, Mr. Goldenberg. What number is that?

MR. GOLDENBERG: 11-F.

13-2 MR. SCHNAYER: Thank you, sir.

1911

BY MR. GOLDENBERG:

Q. The large drawing is Exhibit 11-F. And do you have a copy of Defendants' Exhibit 1-L?

A. This is the one -- 1-L is the electronics article, sir?

Q. Yes, sir.

A. I may have.

I have one, sir.

Q. If you'd turn to Page 88.

A. Yes, sir.

Q. Can you agree with me, sir, that this large Exhibit 11-F is really nothing more than the blowup of the system shown on Page 88 of Exhibit 1-L, with the omission that a synchronizing line at the bottom of the drawing is omitted and a control A and a control B lines are omitted?

A. That, plus the indications here that the data buses are 8 bits and the address buses are 16, that is essentially the same diagrams, sir, and the frequency of the clock.

Q. Now, let's go to Exhibit 13-E here.

Can we agree, sir, that the way the '441 patent works, the processor, acting through the memory, strobes or scans each one of these lines, these vertical lines in succession as a result of the operation of the 1-of-16 decoder?

A. That is such a gross oversimplification that it really does not describe what is going on in the invention, which is displayed on this particular diagram.

Q. All right, sir. Then you tell me, you tell me how the microprocessor acts through the decoder on this single matrix that we see in the drawing?

A. Yes, sir.

The heart of this block diagram, and I assume the purpose that it was created for, is to illustrate how the matrix multiplexing hardware and then the software program that controls it works together; and these strobes here then become very essential to that, because the way this works is, we need to have the lamps and digits on for one millisecond, and then we move to the next column --

Q. Dr. Schoeffler --

MR. SCHNAYER: Excuse me, your Honor, I object. He's cutting his answer off.

BY MR. GOLDENBERG:

Q. -- we have been all through that time and time again.

And all I want to do is to tell me how that system is strobed. Would you do that, sir?

A. Yes, sir.

The sequence is as follows: Under microprocessor control, taking data from the memory, while a given column is active, given column is being displayed, one loads up in advance of the strobing the value for the lamps, that is, the on-off status of the lamps for the next column, but do not turn them on -- does not turn them on;

Sets up the value for the digits for the next column, but does not turn it on, all right;

Selects the next column, and then simultaneously strobes these. And so there is an abrupt switch to the next column simultaneously to yield the noise prevention through those transistors which are not shown here, to do the strobing.

Q. Dr. Schoeffler, I would like an answer to my question.

A. I am sorry, sir; I thought I did.

Q. I don't believe you did, sir.

Can we agree that that strobing is sequentially, cyclically across the 16 lines; that prior to the strobing from one column to the next, the lamps have been set up and the segment drives have been set up, isn't that correct?

A. Oh, yes, I didn't add that it was cyclical and sequential, yes, sir.

Q. The system just does that over and over again, doesn't it?

A. Yes. sir.

Q. When this first column is strobed --and what do we mean by strobing? What does that mean?

A. The word strobe --

Q. Keep it short, sir.

A. Okay. (Continuing) -- simply means after, as you have described it, setting up these two, suddenly turning them on, it is an abrupt signal that comes out.

Q. So this column is enabled; is that a fair way to put it?

A. That is correct.

Q. All right, sir.

A. Suddenly.

Q. So this lamp, any lamp that has been set up in this column, will come on, any segment drive or segment that has

been set up in this column will come on and at the same time any switches in this column will be sensed to see if any one of them is closed, is that correct?

A. The last phrase is not correct. The enabling does turn on the lamps and the digits, and it enables the column in which the switches are in to be read when and if you wish them.

They are definitely not read at that point in time when this is strobed because that would be the high noise time.

Q. When are they read?

A. They are read, as Frederiksen described, offset in time after the --

Q. Lamps have been turned on and the switches --

A. And signals have died down.

Q. But that is a very short period of time, is it not?

A. You are asking for a rather specific number for that, sir, or -- all things that are going into the microprocessor are short --

Q. All right, sir.

A. -- but compared to the other times, I don't know that I would call it short or long.

Those are awkward words there to describe it.

Q. All right. Perhaps that is not a good word.

Then under the computer control, it then goes over

to the next column, where that is done again, isn't that correct?

A. That is correct, sir.

Q. All right, sir, I read to you from the patent, column 3, line 45:

"Processing will further include a step command signal to simultaneously activate the multiplexing decoder..."

and this is the multiplexing decoder right here (indicating), isn't it?

A. That is correct, sir.

Q. "...or sequencing system and simultaneously control the interfacing drive to the display means..."

Now, the display means are either the lamps or the numeric display.

"...to maintain precise synchronous relationship."

A. Yes, sir.

Q. Isn't that what the patent says?

A. That is what those words say in those lines, yes, sir.

Q. Now, do you consider, sir, a system having the architecture shown in Exhibit 11-F -- and let's substitute lamps for a printer and let's put solenoids over here and let's say these are playfield switches instead of keyboard switches.

Do you consider that system to be an infringement of the '441 patent?

And let's put it in a pinball game. I am sorry.

Let's take this system architecture, make these playfield switches, make these lamps, and make these solenoids, and put it in a pinball game.

Is that an infringement of the '441 patent?

A. In order to discuss infringement, it should be done on a specific machine. That rough architecture you just described is similar to what is done in the Williams game, and I have already testified that yes, indeed, the claims read on those games, sir.

Q Can you agree with me, sir, that this system architecture of Exhibit 11-F is different from the architecture of 13-E?

A Yes, sir, I can agree with you that it is different architecture when architecture refers to the key attributes you are talking about, namely, the separation of the matrices into multiple matrices, sir.

Q So in order to have infringement, these game playfield switches, these game lamps --

A I do not agree, sir, that what you are drawing I say infringes the machine. In order to say something infringes the machine, one has to be careful and read the claims on it and look for all aspects of the invention.

Q All right, sir, let's --

A But if you interpret that to be a representation of the Williams games, then I think it is fair, and that architecture does use that Motorola 6800 and does have separate matrices driven from the PIA input/output chips as you have displayed there, sir. So I can agree with that.

Q I haven't interpreted it to be anything, sir. My question to you is that if I take this system architecture and these now become playfield switches and instead of a printer here, I have lamps, and I let this PIA over here drive solenoids and put it in a pinball game, have I infringed the '441 patent?

A What I have to answer, sir, is I have to look at that pinball game and the way that is done precisely, including

how you do this combination of hardware noise prevention, that is, what noise problems you solve in the hardware and then which ones you solve in the software, because that is the way the claims are written and all of the elements must be present in order for me to say that the claims are read.

I was able to do that on the Williams game. This is too oversimplified to allow me to do that.

Q Well, let me make one further assumption. Let me assume that I have put into this system noise suppression devices. Do I infringe then?

A When we go through that claim, such as 45, it is the combination of the noise prevention and the noise immunity. So you have to tell me how the software is organized and how all of this is run.

There are lots of details before we can make a definitive statement like Claim 45 reads on it. That is too oversimplified for me to do that, sir.

Q I am assuming, sir -- I will write it on there. I will write it.

A I am not trying to avoid your question, sir. It is just that--

Q I am just going to write down here --

A -- I can't answer it.

Q -- "plus noise suppression."

Is there infringement?

A Are you presupposing, sir, that we have matrix multiplexing of the switches and some of the displays, that it is operative, that we have a combination of hardware noise prevention and software noise -- the things that I read in the claims? If you are assuming all of that, I can answer the question.

15

Q. The drawing shows matrix multiplexing, doesn't it?

A. But the drawing does not show how the software is running this game, how they are related, one to the other.

It does not show, for example, whether you might at a certain time be reading the switches in a low noise environment. These are key things in Claim 45.

19-2 Q. All that is in Claim 45?

A. Yes, sir.

Q. It is not in the English words of Claim 45, is it?

A. If you read Claim 45 and look for the specific words that the patent uses there, the specific words like noise are not in Claim 45, but they are present in the means plus function language and throughout the specification, sir.

(Brief interruption.)

BY MR. GOLDENBERG:

Q. Assume that it used the noise-suppression techniques that Bally used in its manual that Mr. Lynch asked you about. Would there be infringement then?

A. The only ones Mr. Lynch asked me about were shielding, grounding. There were four. I cannot even remember -- oh, RC circuits, right.

That is insufficient detail to read Claim 45 on that drawing.

Q. I am sorry?

A. That is insufficient additional information to read

Claim 45 on that diagram.

Q Dr. Schoeffler, I am aware that you have been asked this question several times. However, I must ask it again.

A. Yes, sir.

Q What is the invention of the '441 patent?

A. When I read Claim 45, which defines the invention of this patent, what I read is means plus function language, which I interpret by reading the specification carefully, looking into the figures in the specification, and reading the program carefully. What I find is that Claim 45 calls for a microprocessor-controlled pinball game with operative matrix multiplexing.

Now, by the word, operative, I mean that there is a satisfactory combination, a proper combination, of hardware noise prevention techniques, whatever they are, and software implemented noise immunity techniques, so that that game operates properly in the intended environment of a pinball game, which is a noisy environment in a practical way, giving real time response that is adequate and practical and with a practical level of error recovery, so that the game can be used.

That is what I read the invention in in Claim -- is in Claim 45.

Q All right, sir, do you know what the noise prevention techniques are in the Williams Disco Fever?

Let me withdraw that question.

Can we have the game opened, front and back, please?

MR. SCHNAYER: Give me one second, please.

(Brief interruption.)

THE COURT: I think before we get into another game there, this might be a good time to break for lunch.

We will resume at 2:00 o'clock.

(Whereupon a recess was taken herein to 2:00 p.m. of the same day, Thursday, March 15, 1984.)

BALLY MANUFACTURING CORPORATION, A Delaware corporation,

Plaintiff/Counterdefendant,

vs.

D. GOTTLIEB & CO., a corporation, WILLIAMS ELECTRONICS, INC., a corporation, and ROCKWELL INTERNATIONAL CORPORATION,

Defendants/Counterplaintiffs.

) Docket No. 78 C 2246
) Chicago, Illinois
) March 15, 1984
) 2:15 p.m.

VOLUME XIV-B
TRANSCRIPT OF PROCEEDINGS
BEFORE THE HONORABLE JOHN F. GRADY

TRANSCRIPT ORDERED BY: MR. JEROLD B. SCHNAYER
MR. MELVIN M. GOLDENBERG

APPEARANCES:

For the Plaintiff/ Counterdefendant:
MR. KATZ
MR. SCHNAYER
MR. TONE
MR. MATHIAS
MS. SIGEL

For the Defendants/ Counterplaintiffs:
MR. LYNCH
MR. HARDING
MR. GOLDENBERG
MR. ELLIOTT
MR. RIFKIN
MR. GOTTLIEB

Court Reporter:
LAURA M. BRENNAN
219 South Dearborn Street, Room 1918
Chicago, Illinois 60604

THE CLERK: Case on trial.

JAMES SCHOEFFLER, PLAINTIFF'S WITNESS, PREVIOUSLY SWORN

CROSS EXAMINATION (Continued)

BY MR. GOLDENBERG:

Q Dr. Schoeffler, before we adjourned for the noon hour, I did ask you a question; and I have a portion of the transcript here, and upon reading it I'm not sure that you answered my question.

That this Exhibit 11-F from the Electronics article of 1974, that does show matrix multiplexing, does it not?

A That shows a matrix keyboard explicitly on the diagram, and -- and so I guess I would answer that question, yes, it shows a matrix multiplex keyboard.

Q Can you tell us what a PIA is? I see three of them in this drawing.

A Yes, sir. The letters PIA stand for peripheral interface adapter. This is a standard chip that is supplied by Motorola, intended to be used in conjunction with the Motorola 6800 processor.

It connects to the bus that is shown on that exhibit, namely the data and address bus, for the purpose of transferring data from the microprocessor out to devices that might be attached to it, or inputting data from devices into the microprocessor circuitry, sir.

Q So in the case of a printer, the input would be the keyboard, any one of the keys that's hit; and the processor would -- and that would be inputted through the topmost PIA; and then, depending on which key is hit, the printer would respond and, say, if the letter A was hit on the keyboard, the printer would print the letter A. Is that correct?

A That would be an example of a function that you could carry out under program control, sir.

Q Now, they are general purpose devices supplied by Motorola for whatever applications and purposes engineers can find for them. Isn't that right?

A Yes, sir, that is correct.

Q Now, still with reference to this exhibit, in response to a question from me -- and let me give you a copy of that. We have that transcript of this morning.

(Handing document.)

It's at page 1922. In response to my question about what is the invention of the '441 patent, you said this, and I start at line 13:

> "Now, by the word, operative, I mean that there is a satisfactory combination, a proper combination, of hardware noise prevention techniques, whatever they are, and software implemented noise immunity techniques, so that that game operates properly in the intended environment of a

pinball game, which is a noisy environment in a practical way, giving real time response that is adequate and practical and with a practical level of error recovery, so that the game can be used."

Is that your position as to what the invention of the patent is?

A. I was not quite complete in that, and so there are a couple of phrases I would add to that, sir, if I may.

Q. What would you add to it, sir?

A. I referred to Claim 45. And I did not indicate there that it requires matrix multiplexing of switches and some displays, either digits or lamps. I left out that phrase inadvertently.

And what I did not say in my explanation from lines 13 to 21 is that -- that the patent discloses a proper combination of hardware noise prevention techniques and software implemented noise immunity techniques.

And that I have to find a combination of hardware noise prevention techniques and software noise immunity techniques in the infringing machine on which I'm reading the claim.

And if I find such a combination, then that's carrying out substantially the same function as disclosed in the patent, substantially the same way, with substantially the same results.

But aside from that, this is my understanding of the invention, sir, as claimed in claim 45.

T2

Q Is it your testimony then -- and tell me if I misunderstood you -- that you cannot tell what the invention is until you study the patent, claims, disclosure, what you will, in conjunction with some accused device?

A No, that is not correct, sir.

In our discussion of this diagram, I indicated that I could not give you an answer whether an architecture -- I believe that was the word you used -- would be infringing without enough detail so that I could read the claim on it.

I just gave you a definition of the invention, which is independent of any one particular specific machine upon which we might read the claim.

Q Perhaps I misunderstood you.

Now I gather, however, it is still your position that if there is this matrix multiplexing of switches and some displays and it is operative -- and by operative you mean a proper combination of hardware noise prevention techniques, whatever they are, and software implemented noise immunity techniques so that the game operates properly, et cetera -- you stand by that?

A Yes, sir, the requirement, of course, since it is means plus function language, is that it be what is disclosed or the equivalent thereof, and it is equivalent if I find in the other machine the combination of hardware noise prevention techniques, any specific ones, working closely together with

software noise immunity techniques to solve the noise problems.

This is what Frederiksen disclosed in the specification.

Q. You would consider such a thing to be an infringement of the patent, is that correct?

A. If all of those elements are present on the machine of Claim 45, I would say it infringes Claim 45, sir, yes, sir.

THE COURT: If ten years from now someone devises some hardware or some software or both to suppress noise and those devices were never even dreamt of in 1984, let alone in 1973, and that person then builds a Flipper 2 using matrix multiplexing and all the other elements that you have said are necessary, but has totally novel hardware and software which successfully suppresses noise, would that be infringement?

THE WITNESS: It is my understanding of this claim that if there is novel hardware which eliminates noise, then that game would have no combination of hardware and software that solved the noise problem. It would not infringe, or if --

THE COURT: Excuse me. I don't understand that.

THE WITNESS: If 10 years from now someone figures out a piece of hardware, invents a piece of hardware that makes all the noise go away --

THE COURT: Makes everything else obsolete.

THE WITNESS: Well, all noise go away, electrostatic

noise doesn't bother you, switches don't bounce, all of these problems, and it is totally in hardware, then this would not infringe this invention.

THE COURT: No, I wanted you to assume that it would be a combination of hardware and software.

THE WITNESS: If it is a combination of hardware and software that work together to eliminate the noise, I don't know the nuances of the law about radical new invention, but if it is hardware and software that work together to eliminate the noise, that would infringe Claim 45.

THE COURT: So Frederiksen has really cornered the market on any hardware and software which in combination is effective to prevent noise?

THE WITNESS: And the key is that it has to work together. The one or the other by itself cannot do it, and that was what was lacking in the digital logic industry at that time and what made this such a breakthrough and an effective device, that is correct, sir. That is my interpretation of Claim 45.

THE COURT: But if our hypothetical person does it by hardware alone or by software alone, then he is not infringing?

THE WITNESS: That is correct, sir.

BY MR. GOLDENBERG:

Q All right, sir, let's go to the Williams circuits.

Dr. Schoeffler, I have now put in front of you Exhibit 11-D, and I ask you to look at it for a few moments and I will have some questions about it.

A. I have looked at it, sir.

Q. All right, sir, let me look at it for a minute.

(Brief interruption.)

BY MR. GOLDENBERG:

Q Dr. Schoeffler, before I go on to the Williams circuit, I show you once again this exhibit 1-A, which is a page from the Intel manual.

Do you recall that, sir?

A Yes, sir.

Q Put aside the question of pinball games. Can you agree with me that this Intel manual does show, describe, matrix multiplexing in the same matrix of switches and some displays?

Would you like to have the original in front of you before you answer?

A Before I answer that, let me re-read this, please.

(Brief interruption)

BY MR. GOLDENBERG:

Q This next page, 52 --

A I was going to say this page has no reference at all to display, sir.

Q The next page is page 53, and I direct your attention to the last paragraph.

A Yes, sir.

In answer to your question, sir, no, sir, I do not agree.

I interpret the discussion in the last paragraph where Intel is referring to savings and program space and external hardware can be achieved by combining --

Q Perhaps if you were to read it out loud, sir, and I would ask you to do that to complete your answer.

A Yes, sir.

"In systems which combine a numeric display and a keyboard, considerable savings in program memory space and external hardware can be achieved by combining the display scan and keyboard scan. The same loop control and output port logic can be used for keyboard column selection and numeral digit position selection."

Q All right, sir.

A I would have -- I would answer that the paragraph does allude to combinations of hardware since it is referring to a savings in external hardware, not very explicit, but it does allude to that combination, yes, sir.

Q So, in other words, I think you are in agreement with me that the Intel manual, February 1973, does show switches and numeric displays in the same matrix?

A No, sir. I am not entirely in agreement with you.

It does not show how they are interconnected. It merely indicates that it may be possible to achieve a hardware savings. It does not teach how to achieve the hardware savings.

Q. Well, it says that you can combine them in the same scan does it not?

A. Yes, indeed it does say that, sir.

Q. All right.

A. I'd have to explain that.

That can be interpreted as the logic in the software for generating it, for example, this section of the Intel manual is, in my opinion, directed toward the calculator. And so by using that same software routine to cyclically and sequentially scan the keyboard array until you detect a closed switch, do your calculation, and then at a later time display the result, is an equally valid interpretation and probably more likely with the calculator orientation.

Q. Well, don't you save -- by putting them in the same matrix and combining them in the same scan, as the article says, isn't that how you save hardware?

A. If they are in the -- yes, sir, if they are in the same matrix you save lines and perhaps drivers in the columns, that is correct, sir.

And that is indicated by Frederiksen in the patent when he discusses the combined matrix.

Q. And that's indicated in the article that says this is a hardware saving technique, isn't it?

A. It is.

Q. Thank you.

All right, sir. I asked you a few moments ago about Exhibit 11-D. Have you had a chance to look at that a bit?

A. I did, sir.

Q. Can you agree with me, sir, that that is a fair representation of the architecture of the Williams solid state pinball games?

A. No, sir, I would not agree with you on that.

Q. All right, sir. How would you disagree?

A. I would agree that this shows the way the Motorola microprocessor chip set is interconnected in the Williams games, namely, connecting to the bus in the standard fashion.

But totally missing from this, which would really describe the way Williams builds the pinball games, is all of the hardware related to the switch matrix, the lamp matrix, displays, and the solenoids on the one hand; how the interrupt system of the 6800 is used to enforce timing in the Williams pinball games; and, equally importantly, the organization of the program to achieve this equivalent combination of hardware noise prevention and software noise immunity, real time response, and finally the error recovery, any mention of the stuck switch problem as Williams handled it.

Q. Well, perhaps I didn't make my question clear and perhaps you didn't understand it.

My question, sir, was, doesn't this show the

basic system architecture of the Williams solid state pinball games?

And I'm not asking you about software or anything like that.

Can you answer my question yes or no?

A. The direct answer to your question, sir, is, no, because of my definition of architecture..

It could easily be yes, if we redefined the word architecture and if you would indicate that architecture is simply how many switches are connected and whether they're in one or more matrices, at that sort of level, and related solely to this aspect of the hardware, then my answer would be yes, sir.

Q. All right, sir, I'll accept that.

A. Okay.

Q. Now, I think we had agreed earlier that the system architecture of the Electronics article and the system architecture of the Nutting '441 patent were different, did we not?

A. Using the same definition of architecture, we did agree with that, sir.

Q. All right, sir. Again, using the same definition of architecture, can we not now agree that the architecture of the Williams solid state pinball system is different from the architecture of the '441 patent?

A. Using -- yes, sir, using that definition of architecture, the Williams game shows separate matrices and it shows separate input/output drivers for both the columns and the switches.

So the hardware itself, using that definition of architecture, is physically different from the single matrix display that we have on this block diagram.

T5

Q Now I think we had agreed earlier that the '441 patent operated by scanning or strobing over each one of these lines sequentially and cyclically, isn't that correct?

A That is correct, sir.

Q I think we also agreed, according to the patent, that each one of these lines, 16 columns, going through the lamps, going through the switches, and the numeric displays, are all enabled or strobed simultaneously?

A They are strobed or enabled simultaneously, yes, sir, that is correct.

Q That is not true of the Williams system, is it?

A That is not true of the Williams system, that is correct.

Q We will come back to that.

Before the noon hour I did want to have some questions for you about noise suppression in the Williams system, and let's deal with that.

We have opened up the Disco Fever game and opened up the backboard, and if I point inside the backboard, I see metallic shielding all around that backboard and I pat it.

Can you see that from over there, or would you feel more comfortable coming --

A I have observed the Disco Fever shielding, sir.

Q What is the purpose of that shielding, sir?

A Shielding is a well-known technique for hardware noise prevention, notably from external noise.

Q Is there anything in the '441 patent that suggests or proposes shielding for noise prevention?

A The patent does not specifically explicitly discuss shielding as one of the hardware noise prevention techniques. It actually describes explicit hardware noise prevention techniques as only those that were in the preferred embodiment, which is in the Flicker, and Flicker did not have to be shielded. It passed all the noise tests satisfactorily without it.

Q It doesn't inferentially or impliedly suggest shielding, does it, the '441 patent?

A The diagrams, the pictures do not show shielding. The words in the specification do not describe shielding, that is correct, sir.

Q So I take it you are in agreement with me?

A Yes.

THE COURT: About what? You mean doesn't inferentially or impliedly mean shielding?

MR. GOLDENBERG: Yes.

THE COURT: All right.

MR. GOLDENBERG: We get there, Judge. It just takes a bit of time.

BY MR. GOLDENBERG:

Q Now I point to a perforated metal case in the backboard of the game, and it is sitting in the lower left-hand corner.

Can you see that, sir, or have you seen it?

A Yes, I can. That contains the transformer that is used with the power supply for the game.

MR. GOLDENBERG: It is right there (indicating), Judge.

BY MR. GOLDENBERG:

Q What is the purpose of that perforated metal structure?

A That is to shield the magnetic fields which are commonly associated with power transformers from the circuitry that is nearby on the boards.

Instead of the transformer being in the lower cabinet, as it is in Flicker and many other games, the transformer has been put into the upper cabinet and requires then shielding. So that this makes the shielding of the transformer in the upper cabinet equivalent to what was done in the Flicker machine by putting it in the lower cabinet, namely, the separation of the fields from the boards where they might disturb them.

Q All right. So we will come back to equivalency in a moment.

The purpose of that shielding, that is for noise suppression, is it not?

A Noise prevention.

Q Noise prevention?

A Yes, sir.

Q The perforated shielding.

Now, can we agree that there is nothing in the '441 patent which suggests that as a noise prevention technique?

A There is nothing -- I don't know whether to answer it yes or no because I can't remember the exact wording of the question, but there is no explicit mention of shielding of transformers in the patent. That is a well-known technique which would have been known to every practicing engineer in 1973. There would have been no reason to mention it unless it had been used just to document what had been used.

Q There is nothing there inferentially or impliedly, is there, about that noise suppression technique?

A That is correct, sir. It is too well known a technique to list and not all noise prevention techniques known to electrical engineers were listed in the specification. Many, many were not listed.

Q The noise prevention technique used on the Flicker game was something different, was it not?

A Yes, sir.

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Q. The noise technique used in the Flicker game was to take that transformer and put it in what has been called the cabinet or the coffin of the game remotely positioned from the backboard in the electronics, isn't that correct?

A. That is correct, sir.

Q. Would you say they are equivalent?

A. I cannot answer that question with a yes or a no because in reading the claim, I do not attempt to find an equivalence for each hardware noise prevention technique that is in the Flicker in the corresponding games.

What I am attempting to find is the combination of hardware noise prevention techniques and software noise immunity techniques in the game that work together. So I do not look for that when I am reading the claim.

Since the transformer shielding or the separation is one that is inherent in the patent, I do not know for what purpose I would use the word, equivalent. So I just do not know how to answer your question, sir.

Q. It really is, as you said earlier, it is whatever they are; then you find infringement, isn't that it?

A. No, sir.

Q. Well, --

A. What I said earlier was that you must find a combination of hardware noise prevention techniques and software noise immunity techniques working together to solve the noise.

That is equivalent to what was disclosed in the Flicker machine. That is what I look for, the combination working together, and then I say it is equivalent to what was disclosed, and through the means plus function language, et cetera, then I claim the infringement.

Q. All right, sir.

Whatever those techniques are as long as there is this combination?

A. That is correct, sir.

In other words, the separation of the boards is not a specific requirement such that if they are not separated. It is hardware and the shielding of the transformer is a hardware noise prevention technique, one of the many that are used in the Disco Fever, but it is the combination that I look for for equivalence because that is what happened in '73 and which made this so different and which led to the invention.

Prior to that time, the digital logic designers were doing everything in hardware. Computer programmers were doing everything in software. And what Frederiksen did was recognize that you could economically use the combination to solve the noise problems.

THE COURT: You have used the words, working together, and I am not quite sure I understand what that means.

Does that mean that the hardware design for noise prevention must in each instance have some software

counterpart with which it interacts in order to produce the result, or does it simply mean, on the other hand, that the total hardware and the total software addressed to the noise problem must get the job done, whether it acts separately or together in the former sense that I have used the term?

Is that question clear?

THE WITNESS: Yes sir.

THE COURT: All right.

THE WITNESS: I cannot answer it yes or no because I lost track of the sense of the yes or no answer.

But the answer is that there need not be, in my interpretation -- there need not be a one-for-one correspondence; that is, for every hardware noise prevention technique we discover like the shielding of --

THE COURT: Yes.

THE WITNESS: There need not be something in the software.

However, at the other end, if we find eight hardware prevention techniques and three software noise immunity techniques, and there is really no relationship between them, then they are not working together either. It is the marrying of the hardware and the software. There must be some cooperation that so this particular --

THE COURT: At what point do you determine that they are merely living together instead of being married, and by that, I mean you say three would not be enough but eight would be

enough?

Is this a counting process?

THE WITNESS: Absolutely not.

THE COURT: All right.

THE WITNESS: It is not a counting process.

What I have to look for is why the hardware was introduced, all right, and that hardware must make possible the software that then exploits it. That is the working together that we have.

I could give you an example, sir.

THE COURT: Well, now, for instance in Disco Fever, does the cage for the transformer have a software counterpart?

THE WITNESS: There is no correspondence that I can think of for that particular hardware noise prevention technique.

THE COURT: And for purposes of analyzing the infringement issue, would you just simply put that cage aside, take it out of the equation altogether, and go on to the next item?

THE WITNESS: Not quite, sir.

What I would look for in doing the infringement study on the machine is, I go through and identify the hardware/software combination solutions for the various noise problems.

For example, in the case of external noise, in the case of external noise, this is noise that is coming into the system from the outside, that might be coming through the power lines and the like, or electrostatic noise, then I worry about two things, if I were a designer.

One, that the noise pulses that were coming in from electrostatic noise might cause the processor to bomb, was the word we used. That is, the noise would be so severe that it would get on the bus lines of the microprocessor and it could not continue at all.

Now, that is one effect of electrostatic

noise.

The second one we testified about was erratic operation, that is, we read a wrong switch or something like that.

Now, the hardware/software noise prevention techniques I'm looking for are, how do we handle the electrostatic noise problem.

We separate, for example, the boards in the back cabinet from where the electrostatic noise might enter the system.

We shield the transformer so that noise that's coming out of the power lines, that will come into that machine, cannot get to the microcomputer.

But that solves only part of the noise problem.

That must reduce the level of the noise, through hardware prevention, to the level at which software can take over now to eliminate the rest of the noise.

Now, I said that wrong. Not eliminate, but live with it. Because software can't eliminate noise.

And so those are hardware noise prevention techniques.

Now, interrelated with those would be, for example, in the program where I double read the switches. That's done in Disco Fever.

Through the hardware I've brought the exter
noise down to this level, so at least the thing won't colla
and bomb.

Now in the software I can live with it by double reading the switches, so that I will know if I read the switches at a noisy time and re-read them at a later time.

That would be a combination of the marrying.

A second one, which is more obvious and direct, is the use of matrix multiplexing.

When I matrix multiplex, for example, the lamps in the Disco Fever machine, I go from column to column to column lighting the lights.

Now, that's supposed to be all hardware that's going around in there.

But, now, in the program I cause those strobes to be output, and that gives me the self-cleaning action.

So if during noise one of the wrong lamps was lit, okay, it gets corrected the next time I scan through the matrix.

Those are the combinations that I'm looking for when I do the--

THE COURT: If we had a pinball machine which, by virtue of nine items of hardware, unlike anything found in Flicker, was able to reduce the noise level to a bare minimum so that the one piece of software designed for noise prevention was able to finish it off and eliminate all noise, but that one piece of software is totally unlike anything found in Flicker, would that machine infringe?

THE WITNESS: Yes, sir. It is because that hardware/software combination is such that the software wouldn't do it -- I assume from your example --

THE COURT: Yes.

THE WITNESS: -- without that hardware.

THE COURT: Correct.

THE WITNESS: And the hardware wouldn't do it without that software.

THE COURT: Correct.

THE WITNESS: There you are. Those are interrelated, and it would infringe.

THE COURT: All right.

BY MR. GOLDENBERG:

Q Dr. Schoeffler, we can perhaps shorten this aspect of it up.

Can you tell me what hardware devices or techniques are used in Disco Fever which are the same as -- and I underline "the same as," sir -- the same as a device or technique used in the Flicker game or in the '441 patent?

A Yes, sir, I will.

Sir, was your question directed to both hardware noise prevention and software noise immunity?

Q No, sir.

A Or just the one.

Q Hardware.

A Just the hardware.

Q And I stress "the same as".

A Same. Yes. So we would not include -- by saying absolutely identical, so we would not include the trans-

former shield, is my understanding of your question, is that fair?

Q That's correct, the shielding around the back box.

A All right.

THE COURT: I am sorry. Now I have lost the question.

MR. GOLDENBERG: Judge, what I am trying to do is shorten up this portion of the examination, and what I would like the witness to tell me is what hardware devices or techniques are used in the Disco Fever which are the same as those used or disclosed in the '441 patent.

BY THE WITNESS:

A. Here are the ones that I discover that are in my notes, sir.

BY MR. GOLDENBERG:

Q. All right.

A. In no particular order.

The self-cleaning of digits. That, of course, is both hardware and software but is made possible by the matrix multiplexing of the digits.

The second one is the same response for the lamps because they, too, are in a matrix and that permits then software to do the self-cleaning through the matrix multiplexing in the program.

The third one I have on my list is the limiting of the current in a cold lamp to cut down the maximum or peak current and hence decrease the noise. That, too, was done in Flicker.

THE COURT: What hardware does that?

THE WITNESS: On the lamp drive circuits, the transistors and resistors limit that current, sir.

The fourth one in my notes is to put the boards, the electronic boards, in the back box away from the playfield and the noisy elements. That, too, is done in Flicker.

The last is the isolation of the power supply from the logic boards,is what I have in my notes.

BY MR. GOLDENBERG:

Q Let's deal first with the self-cleaning feature.

Isn't it true that every matrix is inherently self-cleaning in the sense that you are talking about it?

A. Yes, sir, if one cyclically and sequentially scans a matrix of lamps and digits, the self-cleaning is there, yes, sir.

Q Now let's talk about current limiting.

How is current limited in the '441 patent?

A. The drive circuits for the lamps use a transistor, which limits the current.

Q Is that the low beta transistor?

A. That is what we have been referring to as the low beta transistor.

Q Tell me once again what beta is?

A. Low beta is the current gain of the transistor, sir, but that is a description of a class of transistors. So the

beta itself, that is just the way those transistors function.

Q What beta values would you call the low?

A In the specification, when the low beta transistor is disclosed in the patent, it specifically mentions low beta being 1,000.

Q Do you agree with that?

A In the discussion in the patent and in the Flicker, that is a particular class of transistor called the Darlington transistor, and that is about as low as the betas get in the Darlington transistor, sir.

Q How high would the beta have to be before you stopped calling it low?

A The beta that is in the Darlington transistors go up into the many, many thousands. There is no abrupt change from low to high.

It is not a technical definition. This is a term that was used by the inventor, Frederiksen, to describe a concept, namely, use of an electronic device to limit the peak currents, and those are his words and his definition.

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Q I understand that, sir. I am asking for yours.

He told us he considered 1,000 a low beta. Would you consider a beta of 50,000 to be low?

A. In a Darlington transistor, no, sir.

Q. That would be high?

A. Yes, sir.

Q. All right, then at least get me to the gray area.

A. The way I would use the term, any beta more than 10 times the 1,000 Frederiksen mentioned I would say would no longer fall in the class that I would call the low beta transistor in the way I use the term.

Q. Sir, do you know whether there are any low beta transistors in the Disco Fever game?

A. The Darlington transistors were not used in the drive circuits of the Disco Fever game, sir, and so the word "low beta" that we have just been discussing is not applicable. Those are normal transistors.

Q. So they are not low beta transistors?

A. They are not Darlington low beta transistors, that is correct, sir.

Q. What is the current -- let me withdraw that.

Well, I take it as a result of the answer that you just gave me, sir, that the device used for current limiting in the Disco Fever is not the same as the device used for current limiting in the '441 patent?

A. Your statement is correct, sir; that is, the specific device is not the same. It is not the same numbered transistor that Frederiksen used, nor is it the same type of transistor, namely, a Darlington; but using a Darlington transistor to drive currents in the lamps, the Williams game uses transistors to drive the lamps.

The hardware architecture in your definition is different, 8 rows instead of 4 rows. We are still using transistors to limit current, and that was the basis of my answer that they are the same.

Q. Do you know in fact what is used to limit current in the Disco Fever game on the lamps?

A. What I did, sir, while studying the Disco Fever schematics, I looked at the transistors in the drive circuit, looked them up, looked at the resistor values, and came to the conclusion that they could indeed limit the cold current of the lamps.

I don't remember the transistor numbers now or the results of my calculations, but that is what I did.

Q. Isn't it a fact, sir, that what Williams uses to limit current on the lamps is not a transistor at all but a shunting silicon controlled rectifier?

A. No, sir, that is not my interpretation of the Williams circuit diagram.

Q All right, sir. Do you have it up there?
A Yes, I do. There is such a circuit in the Williams game. I interpreted that to be a protection against a catastrophic failure; namely,a short, which is different from cold current starting protection.
Q That is your view of it?
A Yes, sir. That is what -- I came to that conclusion.
Q Well, can you agree with me that whether or not you and I have an agreement on what they are there for, that there is a silicon control rectifier shunting each lamp drive circuit in the Williams Disco Fever and other games?
A Yes.
Q This is Exhibit 421. Let's see if we are looking at the same thing.
A We are, sir.
Q We are?
A Yes, sir.

There is a silicon control rectifier that is in that circuit closer to the PIA chips, not exactly shunting the drive.

Q You said closer to the PIA chips?
A Yes, sir.

If you examine the diagram, it is so small in my copy. It is very hard to read the numbers so I can refer to you, but from the PIA chip, the wires come out, and they

first go by the circuitry there and the transistors around that SCR and then move on to the actual, if I am following it right, transistor, through which the lamp current flows.

I am pointing to a transistor -- in fact, it reads Q49, if I am not mistaken. That is the transistor through which the current of the lamp is actually flowing.

I have lost it now.

The SCR is right in here, and that is in this circuitry further back that is sending the current to that drive transistor.

Q What is an SCR?

A SCR is a silicon control rectifier.

Q Generally, how does it work?

A It is a -- just like a diode that allows current to flow in only one direction except it is normally open and no current is flowing until you send a signal to it, and then it acts like a diode. It is like a controlled switch; that is, when you send the signal to it, it is like closing a switch.

Q You understand that that SCR is there for what purpose?

A It was my interpretation that that was placed in there to prevent catastrophic failure; namely, when one is doing matrix multiplexing, if for some reason the matrix multiplexing stops, there would be a very high current going through the lamp, and you really want that to go through the lamp only for a short period, in your case, in the case of Disco Fever, one-eighth of the time. So that silicon controlled rectifier would eventually shut that down in case of a failure.

That would be there, in my opinion, because out in the field, if ever anything went wrong with the microprocessor that stopped it from doing the matrix multiplexing, you would have large maintenance problems. You would always be burning out bulbs or lamps on the game.

That was my interpretation, sir.

Q Is there anything in any of the instructions or operating manuals that would support your interpretation of that, sir?

A I do not recall reading anything like that, sir. It was just my analysis of the circuitry here, and it is conventional in the design of any product to analyze failure modes, and anyone that will contribute to the high field maintenance cost to do that.

So I did not consider it unreasonable or different.

It is like putting a fuse in the power line. You do not expect the game to short out, but when it does, there

is no point in paying a large penalty for it when the fuse is a standard solution to the problem.

Q You do not see that playing a current limiting function?

A Not the cold current lamp limiting function, no, sir.

Q I think, in any case, we do have an agreement between us, there is no low beta transistor in the Williams Disco Fever?

A There is no low beta Darlington transistor. There is a different kind of transistor driving that row.

Q Is there current limiting?

A It was my analysis, sir, that through that transistor and the registors around it in the current that it supplied that it did limit the cold current of the lamp, yes, sir.

Q So that is not the same as what is used in the '441 patent, is it?

A I called it the same. It is the use of a transistor to limit the current.

If you call being the same requiring the precise same family of transistor and the like, it is clearly not the identical component, sir.

Q All right, sir. The next one you told me about was putting the circuit boards in the back box.

A. That is correct, sir.

Q. Separating them from the playfield switches.

A. That is correct, sir.

Q. Hasn't the pinball industry for years put some of the controls in the back box?

A. By controls, sir, are you referring to in the electro-mechanical pinball games?

Q. Yes, sir.

A. I actually don't know the answer to that question, sir. I'm sorry.

Q. We can open up the Flicker game and we'll see.

Is there any question in your mind about that?

A. All I can say is, I've never looked at it to -- that is, I looked at them, but it didn't register in my mind, so I'm not certain.

Q. All right, sir. Well, assuming my understanding is correct, why wouldn't you put some of the electronic controls in the back box?

A. If I were -- I would put the electronic controls in the back box, if I were designing a microprocessor based electronic pinball game, and recognize the possibilities of electrostatic noise and noise introduced by the high currents in the playfield, and wanted to get the separation

to protect the microprocessor and the other components, I would put it back there, sir.

And that's just what Frederiksen disclosed and did.

Q. And assuming my understanding is correct, you would follow industry practice and put it back there, wouldn't you?

A. There was no such industry practice in 1973 for separating electronic circuit boards from pinball playfields until Frederiksen thought of doing it.

Q. I again perhaps didn't make myself clear.

But the industry had put some electromechanical controls in the back box, had it not?

A. If I were following the industry standard, I would have put some of them in the back box and some in the lower box.

And that I hope I would not have done, if I had been a designer, which I was not in those days.

Q. That was good design, wasn't it, good engineering practice, to separate those parts? Wasn't it?

A. I'm sorry, separate which parts, sir?

Q. Well, to separate the switches from the electronics. That's good engineering practice, isn't it?

A. Separate -- yes, sir, separation of electronics that are susceptible to noise from sources of noise is good engineering practice.

It does require you to recognize the noise and take it seriously and include it in your design however.

Q All right. The last one I have is the isolation of the power souce. I think that's what you said.

Now, if I understand that, in the '441 patent and in the Flicker game the source is in the game cabinet, is it not?

A The lower cabinet, that is correct, sir.

Q The lower cabinet.

Now, my question to you, if you might recall, was: You tell me those noise suppression devices, which were the same in the two, that is, the Disco Fever and the '441 patent, and I thought we had earlier agreed that putting the power transformer in the back box and putting the shielding around it was not the same, putting aside the equivalency, was not the same as putting it in the back box.

A You are correct, sir, with respect to the transformer. That is different.

But as I recall from the examination of the Disco Fever, the power supply is in the lower cabinet, is it not?

Q Well, perhaps I misunderstood you. You said the power supply.

A Yes, sir.

Q Are you sure of that?

A I was reading from what my notes are.

May I look at it once more?

Q Surely.

(Brief interruption.)

BY THE WITNESS:

A. I was mistaken, sir. I'd like to go back to my notes to see what I actually have written down. This was on a summary sheet.

In the summary I just gave you I was mistaken. However, when I read the claims on the Williams games, what I actually indicated, according to my notes, that the separation was due to the shielding of the transformer in the back cabinet.

And when I wrote down a summary of all of the different techniques for the game so that I could keep them straight, I wrote down here, "Isolated from the logic boards." And, of course, the isolation is due to the shield.

And we have already agreed that that shield is not the same way the power supply was isolated in the Flicker.

So I read my summary and interpreted it wrong just now, sir.

Q. Now real time and solenoids, in the Williams game would you agree with me that what Williams calls a jet bumper and a slingshot are things which have to be activated in real time?

A. Yes, sir, I agree with you.

Q. The ball hits one of those things and you want it to immediately carom off to goodness knows where, right?

A. That is correct, sir.

Q. You want to stay on the playfield, but...

So you want that in real time.

In the Williams game, how are those solenoids operated?

A. In the Williams game those solenoids are called special solenoids, which means that they are activated either by the microprocessor when the microprocessor wants to close those or by a playfield switch which is directly connected to activate it.

It is my understanding that even though it can be run either way, that during the operation of the game and not during maintenance phases, that it is what we said yesterday with respect to the Gottlieb solenoids, that it was direct driven; namely, the closure of the switch by the ball hitting the switch causes the solenoid control and the microprocessor does not cause the solenoid directly to close.

Q. So the occasion when the processor operates those

solenoids, you are not terribly interested in real time. This is during a testing or maintenance operation, is it not?

A. If my understanding is correct, that that is used only during maintenance, then you are correct; the activation time during maintenance is not.

Q. So during play of the game, when you are interested in real time, the processor has nothing to do with it, isn't that correct?

A. That is not quite correct, sir. The processor does not actuate the solenoid. The processor must in real time detect the switch closure and do whatever functions are associated with the switch closure in any case where, for example, a light must be lit or if there is a score that would be associated, but it does not cause the solenoid itself to close.

Q. How many swit--

A. When -- excuse me, sir.

Q. I am sorry.

A. If we are talking about the six special solenoids in these games.

Q. How many switches are associated with those special solenoids in Disco Fever?

A. I did not count those switches.

Are you asking me how many special solenoids are there, sir?

Q. No, sir, take any one solenoid.

A. I did not count them, sir, to determine whether any switches on that game -- there has to be one to close the solenoid. Normal practice would be if you were going to signal the processor that it was closed, there would have to be a second, but I did not count them, sir.

Q. So you don't know?

A. I don't know.

Q Now, can you tell me whether or not in the Disco Fever game there are diodes on the various playfield switches and the lamps?

A The answer is yes, sir. According to the schematics in the Disco Fever and other Williams games documentation, there are steering diodes in both the lamp matrix and the switch matrix.

Q That is different than what is in the '441 patent, is it not?

A No, sir, it is not. The '441 patent specifically discloses lamps -- I am sorry, diodes, steering diodes, in the switch matrix and in the lamp matrix, sir.

Q All right, sir. I am not going to go through that again. We have dealt with that a number of times.

Let me come back to this drawing and the matter of strobing the matrix.

Very briefly, the matrix of the '441 patent is strobed cyclically and sequentially, isn't that correct?

A That is correct, sir.

Q Under processor control.

Let's assume it starts on the left-hand side. It enables column 1, the lamps, switches and displays in that column, then goes on to column 2, and so forth. Is that correct?

A That is correct, sir.

Q Now let's take the Williams system on strobing. Is it

the same?

A The architecture of the Williams game is different, as we agreed before, because it is multiple matrices, sir.

Are you speaking of all, one, or -- it is different because there are multiple matrices.

Q Well, you and I have agreed on what the '441 patent is.

A Yes, sir.

Q I asked you to tell me is it the same in the Williams system?

A Yes, sir, in the case of each matrix, separately it is the same; namely, the lamp matrix is cyclically and sequentially enabled and the switch matrix is cyclically and sequentially enabled and the numeric display or the digit matrix is cyclically and sequentially enabled, sir.

Q Take any column in the switch matrix, a corresponding column in the lamp matrix, and a corresponding column in the numeric display. Are they enabled at the same time?

A They are not enabled at the same time necessarily.

Q. So that is a difference?

A. That is a difference, not from the patent. It is a difference from the preferred embodiment as disclosed in the patent, which restricts it to the single matrix.

In the section of the patent that you had me read before lunch that talked about this, that was prefaced earlier in that same column by a restriction to the preferred embodiment. So it is not the same. It is not precisely the same as this, but as we indicated in reading the claims on the Williams game, that under certain conditions it is equivalent when we were discussing infringement under Claim 46.

Q. Why is it equivalent, sir?

A. You are asking me why Claim 46 reads on the --

Q. Put Claim 46 aside. You said it is equivalent.

Why is it equivalent? What do you mean by that?

A. The only time I mentioned the word , equivalence, was when I was reading Claim 46 on the Williams game, sir.

Q. Well, you just mentioned it again.

A. But I mentioned Claim 46 at the same time.

Q. What did you mean by it?

A. By the equivalence, I mean Claim 46, among all the other elements, because it includes Claim 45, further restricts or narrows Claim 45 to refer to a single matrix. And because it is not a single matrix, I indicated that Claim 46 does not read literally on this.

Claim 45 does read literally, but Claim 46 does not.

I indicated that under the doctrine of equivalence, if I find that this organization is equivalent in the sense that it carries out substantially the same function substantially the same way to produce substantially the same results, then I can say it is equivalent, and we say it is infringement under the doctrine of equivalence.

I found equivalence by observing that the characteristics of the single matrix, which was disclosed in the preferred embodiment, carries 2 main attributes; namely, the efficiency because of the saving of hardware components, as we discussed a while ago, and, secondly, because that is a prime example of this hardware/software working together principle because, by having them in a separate matrix -- in a single matrix and enabling them, I can offset in time and read the switches at a non-noisy time.

I determined then in examining the Williams games that the advantage of the hardware efficiency had been obviated by the change of the technology, notably the movement to an 8-bit transistor where they need to have 16 columns, which you need for the digits, is not present for either the lamps or the switches, and that in the depositions -- I could look up the pages -- that was indicated that there was no need for that many switches or lamps.

So we go to separate matrices so they can be of

separate size.

However, the separate matrices are organized and driven in the Williams game using a hardware advance available on this microprocessor. That was the interrupt system that did allow me to insure that at the times when I did the digits, the lamps, and the switches, that I was in a low-noise situation with respect to the reading of the switches. And, hence, this hardware/software combination is equivalent to what was done in the preferred embodiment disclosed in the patent, and I concluded then that they were equivalent.

THE COURT: Let's take a ten-minute recess.

MR. GOLDENBERG: Thank you.

(Brief recess.)

BY MR. GOLDENBERG:

Q. Dr. Schoeffler, in the Disco Fever game, tell me how the switches are scanned.

A. In the Disco Fever game the switches are scanned in what is called the background or executive loop of the software in a cyclical and sequential manner.

Q. And by that you mean it starts at one end of the matrix and goes completely through the matrix?

A. The typical situation is exactly the one that you just described, because the purpose of the cyclical and sequential scanning of switches is to detect all switch closures, at least to a practical level in the machine.

Q. All right, sir. Suppose, as it starts through the matrix, it detects a switch closure. What does it do?

A. In the Disco Fever, based on my -- incidentally, this is based on my reading of the depositions; of course, I have no access to the program for the Disco Fever -- it is my understanding that the switches, the switch matrix is scanned cyclically and sequentially.

If in a given column it finds a switch closed, then the program goes off and operates a response to that switch closure to do whatever the game rules require associated with that switch closure.

Q. And so the switch scan is interrupted at that point, is

it not?

A. Yes, sir. In any game when a switch is discovered closed you must do something about it, record it or what have you.

Q. When it resumes the scan, assuming it does, does it continue on in the matrix, or what?

A. It is my understanding from the depositions that in both Disco Fever and the Black Knight it does, the scanning is cyclically and sequential.

In the Flash and the games after the Flash, but apparently up to the Black Knight, that that scan was aborted and then restarted in column 1, sir.

Q. So there's a difference there.

A. I don't consider that a significant difference. I consider it essentially identical, sir.

Q. My question was that there is a difference.

A. From Flicker, sir?

Q. Yes, sir. From the '441 patent, although the '441 patent really doesn't tell us very much about that, does it?

A. The analysis of the program does.

And as I testified yesterday, there are conditions in the program that is part of the patent where, upon detection of the closure of a switch, depending on the particular switch, it does not pick up in the next column again to continue the scanning under those conditions.

And so that these, as I also testified on direct exam, these conditions occur a tiny percentage of the time. When a switch is detected, normally we know the situation on the game board.

And so my conclusion was that this is substantially the same function, namely, cyclical and sequential scanning, whether it starts and stops or not.

Q Dr. Schoeffler, my question was that there is a difference, is there not?

Could you answer that, sir?

A The direct answer to your question is no, there is no difference in the sense that there are times when in both machines when a switch is detected, the successive scans may not proceed in the next column.

Q You spoke of this going off and doing something else, and I think you -- well, I am sorry. Let me put it this way, sir.

Isn't it a fact that the microprocessor can only do one thing at a time?

A No, sir, the correct term is to say the microprocessor can do only one instruction at a time. The effect of that instruction is another matter.

Q So whether we are talking about '441 or Williams or Gottlieb or anything, at any single time it can only sense a switch closure or act on a switch closure or enable a lamp or light a lamp and the same thing with scoring display; it can only act on instructions for those things serially, can it not?

A Yes, sir, the instructions are serial, but the actions that are initiated then are concurrent and can go on long after the duration of the instruction.

Q Well, I am not sure I am understanding you there.

We are scanning the switches and so at a certain period of time, we have detected a switch closure, correct?

Let's talk about the '441 patent.

A Yes, sir.

Q What does the computer do?

A In the computer program that is part of the patent, when it scans a column of switches and determines that one or more is closed, it goes through a column debounce routine, that is, a series of instructions, to determine whether that column has changed from the last time the column was scanned, and if it has indeed changed, it then proceeds with other instructions to determine whether only one switch is closed or more than one.

If only one switch is closed, it then goes off to the sub-routine, as it is called in the patent disclosure, which determines how to respond to that switch; namely, if it is a target, perhaps to light a light or to indicate that that light should be lit, et cetera.

Q In order to do that, a certain number of instructions must be executed?

A That is correct, sir.

Q How many instructions are involved? Let's say the function of the thing is to sense a switch.

A That question can't be answered with a simple number. It depends on where you want to start counting and where you

want to stop ending, but I can answer it in the following way, sir.

The routine in the program that is labeled "Switch" that includes all of the instructions and steps to carry out through the column debounce stage, without counting them right now is probably 15 or 20, something like that.

Q. I counted about 25 at one point in time. It would be in that order, 20 to 25?

A. It is easy enough to look at the program, sir, and determine that.

No, sir, I count 17.

Q. 17, I suspect you are more experienced in reading those things than I am.

How much time is required per instruction?

A. On the 4004 microprocessor, the instruction cycle time is about 10 microseconds, sir.

Q. So that is 170 microseconds?

A. More or less.

Q. More or less.

A. As executing a sequence like that. Not necessarily all the instructions are executed. Sometimes there are branches and jumps around them, but it is on the order of 100 to 170 microseconds, I would guess.

Q. What does it do at the end of that particular routine?

A. At the end of the switch routine, it returns to where that subroutine or switch was called from in the main executive loop of the program. So it returns to that main executive loop of the program, sir.

Q. And does the same thing over again?

A. No, sir, at that point in the program it tries to determine whether there was any change or whether it has to act.

If it does not have to act, it then goes up and starts the entire loop again, which is the multiplexing and the lamps and the digits, the next column, sir.

Q. How does the Williams system work?

A. The Williams systems vary slightly for the 3 representative Williams games, sir. Do you have one --

Q. Well, let's take Disco Fever.

A. Yes, sir. In the Disco Fever game, the executive loop or background program -- people use different terms for these -- it's like the main loop of the Flicker game in that one proceeds through cyclically and sequentially scanning the switches. However, the lamp and the digits, those column operations are handled by hardware interruption to initiate the program modules that move to the next column of digits and the next column of lamps.

Q. That is different, is it not, from the simultaneous enablement that goes on in the '441 patent?

A. Yes, sir, they are not simultaneously enabled, the columns in the Williams architecture.

Q That is in none of the three Williams systems, is that the case? Are they simultaneously enabled?

A In none of the three Williams systems are they simultaneously enabled, that is correct, sir.

Q What was the filing date of the '441 patent?

A I do not know, sir.

THE COURT: August 25, '78.

MR. GOLDENBERG: August 25, 1978.

I am sorry. This is the reissue, Judge.

THE COURT: Oh.

MR. GOLDENBERG: The filing date of the original was May 13th, 1975.

THE COURT: Excuse me.

BY MR. GOLDENBERG:

Q The Electronics article, this exhibit we have been talking about, that is more than one year prior to that date, is it not?

A That is correct, sir.

Q Can't you agree with me, sir, that the basic circuit architecture of the Williams system is a lot closer to the system architecture of the Electronics article than it is to the architecture of the '441 patent?

A You are still using this very special definition of architecture, which is simply showing the combination of the vendor supply chips and the fact that we have a matrix of

lamps and a matrix of switches and numeric displays. The appearance is much closer than that, just for that narrow definition.

Q I just want to be sure that the record is clear. When you said, "than that," that the appearance of Exhibits 11-F and 4-D is much closer to each other than they are to Exhibit 13-E, is that correct, with this definition?

A That is correct, for your very narrow definition of architecture, sir.

MR. GOLDENBERG: All right, sir. I have no further questions.

One second.

(Brief interruption.)

MR. GOLDENBERG: Judge, I have no further questions of the witness.

THE COURT: Yes, I heard.

Mr. Schnayer.

MR. SCHNAYER: Your Honor, can I ask how late we are running today?

THE COURT: Well, I was thinking maybe 5:30, 6:00 o'clock, if necessary. If we can finish up here by 6:00 o'clock, let's do it.

MR. SCHNAYER: Can I have about two minutes of time Judge? It will take one second.

THE COURT: I have got a bunch of other cases set

at 4:30.

Let's see. Nobody has cancelled?

THE CLERK: No, Judge.

THE COURT: We will go until 4:30.

MR. GOLDENBERG: Judge, we are prepared to stay on this evening if --

THE COURT: I have got an hour's worth of work there with the cases that are set for 4:30. So there is no point in your waiting around. It may be longer than that.

REDIRECT EXAMINATION

BY MR. SCHNAYER:

Q Dr. Schoeffler, I show you Page 1502 of the transcript of your testimony of Mr. Lynch's cross examination, and I ask you particularly to read aloud those first nine lines.

THE COURT: Excuse me just a moment.

What I have for 4:30 is not as extensive as I had thought. These are pretrial status hearings. They are not pretrial conferences. So maybe I can wrap that up in 15 minutes or so. So I think I will ask you to stand by at 4:30. I will get back to you.

MR. SCHNAYER: If I can have one minute?

THE COURT: Sure.

(Brief interruption.)

BY MR. SCHNAYER:

Q Dr. Schoeffler, could you please read those first nine lines on Page 1502 of the transcript of your testimony, Mr. Lynch's cross examination?

A Yes, sir.

The question was asked of me:

"Q So what you are saying then, Dr. Schoeffler is effectively Claims 2 and 3 do not alter the scope or content of Claim 1; isn't that correct?

"A No, sir. I have to use the words that I was taught about in reading the claims; namely, it gives

the specific structure in contrast to the means language.

"Q. But you are reading the means language to mean that very structure specified in Claim 2 and Claim 3, correct?

"A. That is correct."

Have you had an occasion to review this testimony to determine whether it is accurate?

A. I have, and I determined that I had misread Claims 2 and 3.

Q. Could you please explain?

A. Yes, sir.

When I was reading Claims 2 and 3, in both cases, I neglected the phrase, plurality of sets, and without that phrase, I think my answer was correct, that when you include the plurality of sets, that puts a condition on the claim, which makes Claim 2 narrower than Claim 1, which it includes, and also Claim 3 narrower or more narrow than Claim 1.

Q And would you please give an example of where some -- we'll take the blackboard, one of these sheets of paper -- and give an example of an arrangement which would be covered by claim 1 and not claim 2.

A Yes, sir.

Claim 2 calls for a plurality of sets of elements.

As we discussed at that time, by a set of elements we mean the elements in a column. And the set must contain two or more elements.

And so a plurality of sets requires the response means in Claim 2 that there be at least two sets or two columns in which there are switches.

And that is not a restriction in Claim 1.

And so if I could draw just an abbreviated diagram of a matrix, where these are the rows and the vertical lines are the columns and they are not connected as usual.

And if I were, in a shorthand way, to indicate with the letter L two rows of lamps, then this would be a matrix, for example, that includes two rows of lamps.

And if I used the letter S for switches and put some switches in a single column like this, then I would have a situation upon which Claim 1 would read but upon which Claim 2 would not read, because I do not have a plurality of sets of response means, namely switches, in claim 2.

Q Now, we can label this -- this is Claim 1 and 2 com-

1930

parison.

And beneath that let's do a comparison of a similar example with Claim 1 and Claim 3.

A An example that would be appropriate to illustrate the narrowing of Claim 1 by Claim 3 would be to simply interchange the letters S and L so that I had only a single column in my matrix in which I had lamps. . . . And as I have a set but not a plurality of sets of lamps, and so in this particular example, Claim 3 would not read on that combination of lamp and switches being matrix multiplexed.

Q Now, Dr. Schoeffler, I think you testified in Mr. Lynch's cross examination -- 20 exhibits which were labeled as Defendants' Exhibits 20-A through 20-E, there are several pages which Mr. Lynch was making notes as you were talking.

Have you had an occasion to examine some of those charts and determine if there are any errors in those charts?

A I have. In particular, when we were creating that chart I was having difficulty expressing some of these various noise references that appear in the patent.

In particular, the ones that appeared on the diagrams that showed, for example, on the diagram that the boards were separated, but where there were no words that specifically said noise, the fact that that appeared in the patent in the diagram, that it would be self-evident to an electronic engineer of the day what that meant.

And we ended up writing "Inferred" in many of these, when the proper term should have been "Inherent". And that would clarify many of those elements if we were to change it and make the diagram a little bit more accurate and useful.

Q. So, for example, it says "inferred" for the low beta transistor.

Is this the correct word that makes this accurate?

A. That's an example of where I would have preferred the word "inherent" in the diagrams.

Q. So Mr. Lynch didn't go back and correct all the areas where you had preferred a different word --

A. No, sir. Part way --

Q. -- he just left the word.

A. Part way through the exercise, the questions, we did switch to those words,but did not go back.

Q. Dr. Schoeffler, have you done a study to determine whether or not Claims 45, 46, 47, 48, 49 and 95, which are the representative claims of the Nutting et al. patent, read on the Flicker pinball machine?

A. Yes, I have.

Q. And what was your conclusion in this regard?

A. I concluded that they do read on the Flicker pinball machine.

Q. Have you testified about this previously at this trial?

A. At great length.

Q. What did you base your understanding of the operation of the Flicker on?

A. I base my understanding of the Flicker on the schematics

that were -- the schematic diagrams that were available for the Flicker machine; the computer program which was submitted as part of the patent; an examination of Flicker where I observed the operation of the game and where I looked at the boards and I looked at the playfield and the like, not with the intent of tracing wires and all that, but simply to see the general organization; and the testimony of Mr. Frederiksen.

Q. Dr. Schoeffler, I show you Plaintiff's Exhibit PX-436 and ask you if you recognize that?

A. Yes, I do, sir. This is a copy of the Flicker computer program which is part of the patent.

Q. And did you use this at all in any of your evaluation--

A. Yes, I did.

Q. -- of the operation of Flicker?

A. I did, sir, very much.

Q. And Dr. Schoeffler, I'm also going to refer you to Plaintiff's Exhibit 28, 52 and 53 -- and unfortunately we don't have enough stands here -- but I'll see if I can rest that on there -- this is 52 and this one is 53 and here is PX-28, and I'll try and rest these up here.

And I ask you to identify those -- excuse me one second.

(Brief interruption.)

BY MR. SCHNAYER:

Q. Yes, this is the right one, PX-28.

A. Those are blow-ups of the two schematics and the copy of the mux chart from the patent that I used as part of my study of Flicker, sir.

Q. And you testified with respect to those on direct examination about the operation of the Flicker. Isn't that correct?

A. That is correct, sir.

Q. Now, Dr. Schoeffler, did you have an occasion during the last recess, the five-week recess, to compare the schematic diagrams to the Flicker machine, PX-333, to determine whether the circuitry contained in that machine is the same as the circuitry that's shown in those schematics?

A. Yes, sir, I spent about a day and a half looking at the underside of the playfield and looking at the wiring that comes down into the playfield; and I looked at the circuits on the driver board and traced the wires in the playfield up to the driver board.

And I tried to examine all the chips without touching them that were on the CPU board in the system.

Q. How much time did this take?

A. I spent about a day and a half doing that, sir.

Q. Dr. Schoeffler, I show you Plaintiff's Exhibit 28-A and ask you what that is?

A. That is the same circuit diagram as I believe is Exhibit 28, which is the circuit diagram of the CPU board that I had studied, and what I did there was color in the changes that I was able to detect by doing chip comparisons and examination of the CPU board without tracing wires.

Q. Dr. Schoeffler, will you go through each of those yellow portions on the PX-28 and explain what significance, if any, they have in the operation of the Flicker game?

I believe they are numbered. Maybe we could start with No. 1 and then work up to No. 4.

A. Yes, sir. I found four changes in comparing the chips with the schematic.

This is the schematic diagram of the small board in the back of the Flicker, where the microprocessor itself is contained.

Q. Maybe you could explain what a schematic diagram is so the Court understands.

A. All right, sir. Each of these little rectangles represent one of the electronic chips. This happens to be the 4004 CPU.

All of the lines here indicate the wires that

connect them together, along which data runs.

Q By the chips, you mean those are the little black things with the legs coming out?

A That is correct, that populate these and have the electronic circuits within them, the small Domino-like things.

Now, what I found was the following: Starting here in the lower right-hand corner with No. 1, this is where the input/output section of the Flicker hardware is done, namely, the setting up or the enabling of the segments for the digital displays, the setting up of the outputs for the lamps, and a row for reading the switches.

On this diagram there was shown a second row for possibly reading switches in, which apparently was never implemented or wired, and as a consequence, the resistors and this chip, which is labelled 14502, in the lower right-hand corner of the diagram are not present.

That is totally consistent with the organization of the software, the testimony of Frederiksen, and the like.

There was only one row of switches -- I am sorry, one row of -- one set of four rows of switches in the Flicker game. They were read in four at a time.

So Item 1 shows the missing chip and these. This has no consequence in the operation of the game whatsoever.

The second change --

MR. GOLDENBERG: Your Honor, I object to this line of

questioning and its continuation. It is far, far beyond the scope of any cross examination of this witness.

THE COURT: Well, it may be. On the other hand, it does relate to the matters that we talked about before the resumption of the trial, and I will consider this a re-opening of direct examination for the purpose of clarifying the record.

MR. SCHNAYER: That was our intention, your Honor. Thank you.

MR. GOLDENBERG: Thank you.

THE COURT: I think this is the time for me to interrupt briefly to take these other cases.

MR. SCHNAYER: Thank you, your Honor. Could we just leave the --

THE COURT: Yes, you can just leave everything there. You can leave all your papers there.

MR. SCHNAYER: Thank you, your Honor.

(Brief recess.)

THE CLERK: 78 C 2246, Bally v. Gottlieb, case on trial.

THE COURT: While I'm thinking of it, let me advise you that tomorrow we won't be able to get started until 11:00 o'clock. And then we'll go all day Friday.

MR. TONE: May I inquire of your Honor about how late you will run? I have scheduled a trip down to Champaign--

THE COURT: Today, you mean?

MR. TONE: No. Tomorrow.

THE COURT: Tomorrow.

Well, no later than, why don't we say, 5:30.

MR. TONE: All right. Thank you.

BY MR. SCHNAYER:

Q Dr. Schoeffler, you were testifying about these various portions of the circuitry on PX-28-A, and indicating what significance they had, if any, to the operation of the Flicker game.

Would you please continue with that explanation.

A Yes, sir.

I had indicated that the chip in the corner that I had numbered with the red letter 1, the 14502 and associated resistors, were just absent, and that that was consistent with the operation of the program, et cetera.

Because there is only one row -- one set of

four rows for switches. And it has no effect whatsoever; it has no significance whatsoever on the operation of the Flicker.

Item 2 on my list is associated with the switches coming into the CPU board.

And the schematic originally showed an electronic chip whose number is 14502.

These chips are all standard chips that you can look up in vendor catalogs, and they have different types. And so they were commonly abbreviated with numbers such as this.

This has been replaced by another chip, 14016, which did substantially the same function, namely, allowed the switch inputs to be put onto the data lines and put into the memory of the computer.

And so this change, too, had no effect whatsoever on the operation of the Flicker machine.

Q. Now, how many rows were there in the Flicker machine that you testified about, how many rows of switch inputs were there?

A. There were four rows of switch inputs in the Flicker machine, and that's in agreement with the entire operation of the computer program, the debounce routine and all that.

So all of this is consistent. There is no change of significance.

For some reason this chip, one chip was used instead of another on the board itself.

The third change from the schematic that I've labeled 3 is also in the right-hand corner, and this is associated with the lamp drive circuit.

This is a typographical error, a draftsman error, in my opinion.

The chip on the original schematic is labeled 14543, and what is actually present on the board is a chip called 14042.

And it appears that the draftsman, in drawing this, copied the wrong number. Because right above it on the diagram is another chip with that number.

It would have been electrically impossible for that chip that was originally there to have carried out that function.

And shown on the original diagram were the pins associated with the chip, and those are entirely consistent with the pins specified for the chips adjacent to it, which also are 14042.

So these three chips on the board are actually identical and are displayed as identical here.

And looking at the electrical function, it must have been a typographical error, and so it has no significance to the operation of the machine.

Q. Now, you indicated that there were pin-outs that are shown. What significance do these pin-outs have with respect to your reason for concluding this was a typographical error?

A. The numbers on the wires, if one looks it up in a vendor's catalog, can be associated with the physical pins or connections to the board. And that determines what the function of that pin is and how it must be used.

And the pin numbers here are consistent with the pin numbers on the other 14042 chips; totally inconsistent electrically with the one that was there.

So it had to be a typographical error.

Q By the 1 to 30, you mean the 14543?

A Yes, the one that we indicated, that is correct.

The last change is across the top of the diagram, and I have labeled it as 4, and it is actually shown in several parts. I have colored in or highlighted with yellow these little triangular buffer electronic circuit devices that are shown up here, and there are five of those.

Unlike the chips, which are shown as rectangles, these designate electronic circuits, and when one implements or builds this, actually, six of those little electronic circuits are contained in one chip.

What we found -- what I found on the circuit board is that one such chip was changed. The circuit diagram here calls for a chip whose number is 14050, and it was changed to a chip whose number is 14049.

It turns out that the electronics in those two chips are essentially identical in function except for one characteristic. The 14050 electronic circuit passes the data through that is coming in on the one side to the other side and isolates the two sides but does not change the data.

The 14049 that is present on the Flicker does the same thing except it inverts the data; that is, if the data coming in was low, it changes it to high, and if it was high, it changes it to low. But aside from that, there is no change at all.

Now, elsewhere on the circuit diagram there are

many of these 14049 chips used, and, apparently, at the time this was constructed, the 14050 was changed to a 14049. For what reason I do not know, perhaps lack of availability of the chip. I do not know.

Now, the effect of this on the diagram, since the electronic circuits appear in three places, is the following: Four of them appear near the center top of the diagram and are associated with the timing signals called the clocks that run the microprocessor.

Changing the 14050 to 14049 electronic circuits has no effect whatsoever on that. So these are interchangeable as far as this portion of the circuit is concerned.

On the left, changing the electronic circuit 14050 to 14049 in this portion of the circuitry called reset, which is used to reset the processor or start -- restart it under a certain condition -- required that that changing of the data from low to high be removed.

So it is my understanding that there are actually two of these in here instead of one.

So I have labeled this as 2-14049.

So in order to make this change of circuit, an extra one of these was put in there. The first one changes the data, and the second one brings it back again.

So this function of the electronic circuit is not changed at all and has no effect at all on the operation of the device.

Now, the last one over on the right is on the test line of the microprocessor, and this is the one that Frederiksen referred to as the priority line. This is the one where you read the switches associated with the tilt and the slam and the coins and the like. By interchanging those two circuits and inverting this, this means that when you look at the test line, instead of -- because this changes the voltage from low to high or high to low -- when you see a switch close, which would normally mean low, it now looks high.

So this changes the way the switch signals come in. So this had to be compensated for for a partial change in one of the instructions as used in the computer program.

So apparently on this board, this one chip, the 14050, was replaced by the 14049, a change in this reset circuit to add the extra one, and then there had to be a change in the computer program of this one instruction, so that it would continue to operate properly.

Aside from that, there is no effect on the operation of the Flicker pinball game due to these changes, and so there is no significant change in the operation nor significant effect due to these chip changes.

Q Dr. Schoeffler, were there any other portions of the circuitry of the Flicker, the actual physical embodiment of PX-333 which you determined were not identical with the schematic diagrams which you have been testifying about?

As you identify those, if there are any, could you please indicate how those would affect the operation of the Flicker, if they have any effect at all?

A Yes, sir. This is the CPU board. There were some changes.

I mentioned one of them in cross examination yesterday; namely, in the solenoid that operates the flipper, there was a change that made the solenoid run more quickly, to pull in more quickly, some change there which was not reflected in an updating, or it did not appear on the circuit diagram that we have been talking about, which is right -- well, this circuit diagram right here. That is, it is not shown at all on the circuit diagram. It has nothing to do with the invention or its operation. It is a speed-up circuit on the solenoid, and that is the one that I mentioned yesterday that, as part of that, there appeared to be a resistor on the driver board that was cut for some reason.

A second one was, on the driver board, there appears a large power resistor, which appears to be part of the voltage regulator circuit, and it does not show on the power supply portion of this schematic the use of that kind of a resistor, and the power supply is rather conventional and has nothing to do with the invention or the --

Well, it has to with the operation of the power supply. That is what helps to make it function properly, but it has nothing to do with the invention.

Q Dr. Schoeffler, prior to the five-week break, on direct examination you testified that the representative claims read on the Flicker based on your understanding of the operation and construction of the Flicker at that time. You concluded that each of the representative claims reads on the Flicker based on your understanding.

What significance, if any, do these differences which you have just testified about have on your analysis of the claims reading on the Flicker?

A The only effect that I mentioned was, of course, that one chip change required the change in the test instruction so the switches were read properly, but aside from that, there was no effect whatsoever on my understanding of the operation of the Flicker which I determined from the study of the schematics and the computer program and the testimony of Frederiksen, none whatsoever.

Q Dr. Schoeffler, are you aware that the last several weeks -- it was prior to the break sometime -- an exact paper printout of the instructions of the computer program that is contained in the E-PROMs of the Flicker, PX-333, has been generated?

A I was aware that the contents of those memories were dumped and printed on paper, as you say, yes, sir.

MR. SCHNAYER: For the Court's information, defendants had requested that such a printout be made, and we had

cooperated with them and found a non-destructive method of printing out the program as contained in those PROMs, and a copy of that was done by Dr. Vacroux when I was present.

A copy of that was taken by Mr. Frederiksen, who will be testifying later on. We will recall him for the purpose.

He did what is called a disassembly of that program. The program of the PROMs is contained in what is known as object code, and to make it in a readable form for humans, he turned it into what is called --

THE WITNESS: Symbolic.

MR. SCHNAYER: -- symbolic, excuse me.

A copy of that was given to Dr. Schoeffler for his analysis to compare it with the program listing in the Patent Office, and that is the testimony I am asking about now.

MR. GOLDENBERG: Your Honor, I suppose I made the objection earlier with respect to this kind of testimony at this time and the scope of the cross examination of this witness. I take it your position is the same?

THE COURT: Yes, you may have a continuing objection, and I am just taking it at this time, even though it is beyond the scope of the cross examination. It still is a necessary part of plaintiff's case. The witness is here, and this is the logical time to do it.

MR. GOLDENBERG: Thank you.

MR. SCHNAYER: Thank you, your Honor.

BY MR. SCHNAYER:

Q. Dr. Schoeffler --

THE COURT: While I am thinking of it, I would appreciate your giving me a memorandum on the question of a computer program being part of the patent claims, if that is what the contention is here.

I am not troubled by the idea of patenting a computer program because I believe that can be done. I think there is law to that effect. What I am not clear on is whether you can just simply file a program in computerese and have that regarded as a part of your claim.

Ordinarily I think of claims as something that someone can go to the Patent Office and read and understand, and what makes me ask this question is the thought that maybe we have now entered an era that in order to understand something, you have to go out and hire somebody to read it for you.

Is that indeed the case now?

MR. SCHNAYER: Well, the patent is directed to a person with ordinary skill in the art, a digital logic designer.

The patent references an MCS-4 manual. It is not written for just anybody. It is written and directed to a certain type of person.

The manual that is referenced in the patent application describes all of the instructions in the program listing, and that is perfectly acceptable --

THE COURT: But it doesn't have to be written in English?

MR. SCHNAYER: Well, that is language to a computer person. It is just like French or --

THE COURT: All right, give me some law to that effect.

MR. SCHNAYER: Sure, your Honor.

THE COURT: And law to the contrary if the defendants argue with that.

Now, if you agree on what the law is, then we don't need a memorandum on it.

MR. LYNCH: No, may it please --

THE COURT: I don't know what the law is, and that is why I am asking.

MR. LYNCH: No, your Honor, I just want it to be clear that it is also our position --

THE COURT: That it is not part of the patent?

MR. LYNCH: And your Honor understands it is not in the printed patent?

THE COURT: I understand that, but assuming that it is somehow part of the patent, what I want to know is how does that come about?

MR. SCHNAYER: Do you contend that that is not part of the patent?

If it were part of the patent, you contend it

can't be used to interpret the patent?

MR. LYNCH: I contend it is not part of the patent. I contend it was never intended to be part of the patent, and I contend that no one could, without a further textual explanation, read in what Dr. Schoeffler has read into these claims under the patent law, yes, that is correct.

BY MR. SCHNAYER:

Q Dr. Schoeffler, I have just handed you PX446 and ask you to your understanding, what is that?

A This is a copy of a document that it is my understanding was prepared by Mr. Frederiksen and is what you a moment ago referred to as the disassembled symbolic version of the dumped program; that is, it is the symbolic version of the program as it actually appears right now in the Flicker memory.

Q. And just so the Court understands, maybe you can explain the different columns that are here and compare and explain what each of these lines mean with respect to what's contained in the actual E-PROMs themselves.

A. Yes, sir.

The instructions that we've been talking about that the microprocessor actually carry out in symbolic form are listed down the center of the document.

For example, the first one is an instruction called FIM and FIN and JMS and FIM, et cetera.

Each of these instructions is explained in the Intel manual as to what it does with data, whether it brings data in or sends data out or adds two numbers together or what have you.

THE COURT: Are you saying that a person of ordinary skill in the art or arts that are involved here could read this document along with the Intel manual and understand exactly how this works?

THE WITNESS: Yes, sir, for the purpose of understanding the operation of the patent and in particular the critical things in the patent, the noise immunity things and the real time organization of the program.

The typical engineer who studies computer program is accustomed to actually writing this and reading it and interpreting it. That is correct, sir.

MR. SCHNAYER: We'll get into some questions about that, your Honor, which I think will clear them up for you also.

THE COURT: All right.

THE WITNESS: And the other thing that is of interest here is, in the third column of this listing, inside square brackets, you observe numbers like 22, 24, 53, and further down, A 0 F C B 0.

Those are the codes that actually are in the memories of the computer. And those are called object code. They're just a series of numbers.

No one can read those and follow them. Laboriously you can decode them by looking backward through the manual, and so on, but it is very difficult to follow.

As a consequence, all design and analysis is done with the symbolic version on the right, that with a little practice one can learn to read rather well, especially if you're accustomed to computers.

What Frederiksen did was to take what was dumped from the ROMs, namely all these numbers, and work them backwards to produce the symbolic listing so we could read it and discuss it, and in particular tell what's different about the actual instructions in the Flicker machine now versus the instructions that were listed in the program that was filed with the patent itself.

BY MR. SCHNAYER:

Q Okay. Dr. Schoeffler, could you please -- strike that.

THE COURT: I want to keep this as brief as possible on direct examination, and let the defendants go into it on cross examination, if they contest what he is saying.

In other words, I don't want to go through this whole computer program.

MR. SCHNAYER: Well, he's just going to go through examples --

THE COURT: All right. Because I'm not going to understand it anyway.

MR. SCHNAYER: Yes. We've tried to do it so that your Honor can understand it. We're not going through everything. We'll try and go through just an explanation.

THE COURT: All right.

BY MR. SCHNAYER:

Q Dr. Schoeffler, do you have a copy of Plaintiff's Exhibit 436 up there?

A What is 436?

Q I think it's the program listing.

A The one that was filed with the patent?

Q Yes.

A Yes, sir, I have that.

MR. SCHNAYER: I believe the Court has a copy already.

BY MR. SCHNAYER:

Q Could you please identify what that is.

A. That is the symbolic version of the program that was filed with the patent and is part of the patent, sir.

Q. And did you use that particular version in your first analysis of the operation of the Flicker?

A. That is the version that I used prior to receiving this sometime during the break.

Q. Now, with the Court's instructions in mind, could you explain the differences that are contained in this program listing, PX-436, and the program listing which is actually contained in the PROMs, PX-446?

A. Yes, sir, I will attempt to do so.

When Frederiksen produced this new symbolic version, what he did next to the column with all the numbers that were dumped out of the ROMs is put a double asterisk wherever he found something that differed between the one that was filed with the Patent Office and the one that was actually in the memory itself.

And so to answer the question, what is different, we can look at the asterisked instructions and see their effects.

And I colored in what I considered the significant -- a summary of the significant differences here. There are several points.

First, you will notice that, taking a look just at the first page, that there are only 3 asterisked instructions on the first page.

More significant about that, however, is the fact that all of the other instructions not only are identical to what was in the program that was listed with the Patent Office, but they are at exactly the same location within the ROMs.

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Q. Are these the same programs?

A. These are the same programs.

The one that is in the ROM right now is simply a debugged version, further debugged version of the one that was filed with the Patent Office.

And that's why I considered this fact so significant, that the instructions had not been moved.

The normal practice in preparing a computer program then, at that time, when Frederiksen was doing something -- was doing this work, was --

THE COURT: Excuse me. Mr. Lynch.

MR. LYNCH: May it please the Court, your Honor, if he wants to explain the differences, fine. Mr. Frederiksen can explain what his practice was and how it wound up being that way.

THE COURT: I really think it would be more efficient if Dr. Schoeffler would just state his conclusions. These either are or aren't significant, and then let the defendants cross examine.

You may go through 30 of these things, and they may only take you on on one or two of them, and meanwhile we've wasted time on 28 things.

BY MR. SCHNAYER:

Q. If you can keep it real short and just a summary of --

A. I listed 6 conclusions, okay. And so that will summarize

them very well.

The first one is that the bulk of the program is identical. That is, 88 percent approximately of these instructions are identical to the original version and are in exactly the same location.

This means that, when he loaded those instructions in the program when he first created it from the version that was filed with the computer program and then tested it, he must have found errors or other things that either were not working properly or at least working to his liking.

And he went in and --

THE COURT: Let me say this: He's going to be here to say what went through his mind.

Why don't you tell us -- and I'll ask the questions: Have you found any significant differences between these two programs that would have anything to do with the operation of the machine?

Now, if the answer is yes, let's see which ones they are.

THE WITNESS: The direct answer to your question is, I found no differences that were significant to the operation of the Flicker machine in any of the sense that we've been interpreting the patent or the claims.

That is, the structure of the organization and the like I found to be identical.

Now, the operation of individual little modules as, for example, what one does precisely when a coin is discovered, was changed.

Just to take one example, it appears from this diagram that the program he wrote, when you inserted a coin, if it was supposed to give you 2 games, was supposed to make two knocks, two sounds in the game. And I believe it made only one.

And so he changed around the sequence of a couple of instructions so it would make 2, which is what the game rules say.

Many of the changes are of that nature. Okay.

Or they are actual errors. That is, he apparently, when he wrote the program, made a mistake. He wanted to turn on this light, and he accidentally turned on this light.

So he went in after the program had been completed, made the changes, and put them in the ROM.

The other thing that is different about this listing of instructions and the one that was submitted to the Patent Office, is that the Patent Office is the full symbolic program.

When you dump out what is in the ROMs, you also get some data area called a transfer or a jump table, which normally I assume that he entered manually after he had prepared the program. And that appears here, and so it looks

different.

And what I did with the colored crayons is circled this, and that portion of it is on Pages 6 and 7.

The only other change in appearance of this, other than the asterisked changes, is at the end.

And because he was fixing errors -- if you just have to make a small change to an instruction, you just go in and change that instruction. But if, in order to fix the error you have to replace one instruction by two, you can't shove them all apart and stick two in.

And so what he was forced to do was put those changes at the end of the program.

And so that is -- the net result of this is, of all the instructions, roughly approximately 88 percent are identical; I found approximately 5 percent of the 12 percent that were changed were due to a commonly-occurring bug which I would call a register assignment problem. It arises all the time.

And 2 percent of those were due to having to jump around to put the extra instructions at the end.

And the rest were just the correction of minor errors here or there.

But I found that the operation of the program was not significantly changed and would not have affected any of my conclusions about the way the Flicker machine operated,

especially anything to do with noise prevention, noise immunity, the real time response, the sequencing, the offset in time, all of these things that are at the heart of the invention, there is no change in those.

BY MR. SCHNAYER:

Q Doctor, I am going to ask you to do this quickly and just summarize what these charts are.

I ask you to look at these charts and explain what they are.

We have PX-467-A and 467-B.

Can I have a copy for the Court, please?

(Brief interruption.)

BY THE WITNESS:

A I can use the one up here.

In order to be certain that the conclusions I had drawn from analysis of the program that was filed with the patent were no different after the change, I went back and took and determined from the program that the symbolic program that was filed with the patent, the way it operates and the significant aspects of it, as I would expect someone would do; namely, a digital logic engineer, after he had studied the 4040 manual that is referenced in the patent to learn to read the computer language -- so that he would be able to learn what is going on in the system.

And I drew these diagrams, this one diagram, one of which shows the structure of this program, and the other of which shows what I have been referring to as the executive loop.

The executive loop shows the key sequence of

operations that one goes through to cyclically and sequentially enable this single matrix multiplexing and carrying out the multiplexing, the reading of the switches, offset in time, and the like.

As it turns out, all of that is within the routines which I boxed on pages 1, 2, and 4; that is, he would start reading at the front and quickly discover that this routine, which is labeled "main" for the main routine is the one that controls this executive loop.

It shows the sequence we have gone through a hundred times now; namely, enable the lamps, enable the digits, wait a little bit, read the switches, respond, et cetera.

It also shows then in that sequence of instructions at the bottom of this executive loop on Exhibit 467-A the debouncing that we have been talking about.

It shows the double reading of the columns of the switches. It shows the double reading of the test line because they are very clearly labeled so in those various modules.

And at the bottom it shows that when you have detected that a switch is closed and you have to respond to it, that as instructed in the text part of the patent, that you go to subroutines -- is what Frederiksen called them. Those are the various little modules with a name out to the left that are in the program.

If one just examines some of those, you find ones called the target routine, the spinner routine, the tilt routine, and these are the routines that carry out the functions with the obvious names.

I have also shown one routine that is different from one of those over on the right-hand corner because, as you read through each one, this, too, would leap out as being significant, and I label this an example of a lengthy routine.

This is intended to show that as you go through and have to do lots of instructions that take a long time -- the microprocessor is fast, but as indicated in some of the testimony, to do a scoring routine may take a quarter of a second, and that is too long to not do anything else.

This shows Frederiksen's routines all going out and repeatedly during that interval doing the so-called mux routine, and that is what keeps the lights burning during that time.

THE COURT: Excuse me for just a minute.

THE WITNESS: Yes, sir.

THE COURT: Are we in the context of explaining these problems that arose during the recess putting in the direct case again?

MR. SCHNAYER: Well, your Honor --

THE COURT: This sounds like an endorsement of the Flicker machine, which we have had a lot of so far.

MR. SCHNAYER: If I can maybe explain to the Court, Dr. Schoeffler has drawn these structural charts. Now, I will ask him to indicate --

THE COURT: I mean, what I have been hearing for the last few minutes, it seems to me, is repetitive of the testimony I have heard before about how the thing works and why it is a good invention, and so on.

MR. SCHNAYER: Well, the issue involved is whether that program listing which was submitted to the Patent Office taught the invention, and that was one stage of the program listing which was contained in the Flicker pinball machine. There were some changes to it.

He has testified now about what is contained in that one version.

What we are ultimately trying to conclude is it taught a person of skill in the art what you need to do to practice the invention. Now, these charts illustrate that.

THE COURT: Well, I think this really is direct examination that might have been conducted weeks ago. This is not something that becomes relevant only because it has been learned that there are changes in the program.

MR. TONE: May I say a word, your Honor?

THE COURT: Yes.

MR. TONE: As I understand the purpose of this, it is to show that the substance and thrust of the program were in the programs that were offered initially and that the changes shown by the dump program are not material.

THE COURT: It just seems to me that he has already said that here this afternoon on the examination by Mr. Schnayer. Going through another few charts is not going to make his testimony more understandable to me.

MR. SCHNAYER: If we could just identify the charts for the record and possibly for --

THE COURT: Put them in.

MR. SCHNAYER: Dr. Schoeffler in a couple of seconds can indicate what they are. That should be sufficient, just so we have a record made.

THE WITNESS: Yes, sir. I drew these charts so that --

THE COURT: Once he says that the program is essentially the same -- I mean, we know that it has to be able to operate the machine; otherwise the machine would not have

operated. So it is not surprising to me that charts of this kind can be prepared.

Frankly, it does not prove anything beyond that which has already been testified to.

MR. GOLDENBERG: Your Honor, they have already in an earlier submission to you said this, that unless the changes were made -- their characterizing was obvious -- the game could not be played.

THE COURT: Well now, that is the kind of thing you want to go into on cross examination.

MR. GOLDENBERG: That is right.

THE WITNESS: What should I do?

BY MR. SCHNAYER:

Q Again in a couple of sentences explain what these are and what significance these charts are, just so we have an understanding what they are.

A I drew these charts simply to show in detail that the things that I had deduced from the program from the Patent Office were not changed by any further examination of the program that has been dumped, and this shows the structure and organization of those routines in detail and the noise prevention and immunity things, and they have not been affected, in my opinion, by the dumped program.

Q Those charts, for the record, are what numbers?

A The exhibits are labeled 467-A and B, sir.

Q Dr. Schoeffler, would it have been obvious to a person of ordinary skill in the art, having the program listing that was submitted to the Patent Office, to make an operative program for a particular microprocessor hardware system for a pinball machine?

A In my opinion, a digital logic designer who was either working with someone who was knowledgeable about game rules and other characteristics of pinball games or himself had

that knowledge could read the patent, find the reference to the 4040 manual, understand it, and then produce the kind of diagrams that I have shown here, which would teach him the part of the invention that in software was critical and use the unknown and not taught in the 4040 manual, namely, this executive loop and the time offset and the noise immunity considerations as they are shown here, yes, sir.

Q Dr. Schoeffler, the defendants have stated to the Court that some of the parts contained in the Flicker have date codes which apparently are later than September 26, 1974, which is the date the Flicker was demonstrated to Bally.

Would you please explain what is meant by those date codes?

A It is customary in manufacturing any product, and especially electronic products, to put sufficient information on the products so that quality control can be carried out, and in particular codes which indicate the date of manufacture of these chips are normally included on each chip so that at a later time if a chip fails or does not meet specifications, the vendor, the manufacturer, that is, can go back and determine when it was manufactured, with what other chips, and the like.

So if you decode those numbers, you can tell the approximate time of manufacture of the chip.

Q Dr. Schoeffler, certain parts on the Flicker board

apparently contain date codes which are after the September 26, '74 demonstration to Bally.

Assuming, one, that during the September 26 demonstration, the Flicker contained the integrated circuits with the same part numbers as those contained in the Flicker today and, two, that those parts were replaced with the parts which are actually in the machine today, what effect would this have on the operation of Flicker in your opinion?

MR. LYNCH: Objection, your Honor. One of the issues is was it demonstrated on September 26 and in what condition was it as of that date.

I think, your Honor, that insofar as if the witness wants to testify about the chip comparison, that is fine, but to make a theoretical or hypothetical question --

THE COURT: Well, he is being asked a hypothetical question. It doesn't hurt anything. Overruled.

I understand that he doesn't know what took place. He has to assume.

BY MR. SCHNAYER:

Q. Can you answer the question?

A. The question is assuming that -- I am sorry. Would you mind repeating your question, sir?

Q. Yes, assuming, one, that at the time of the demonstration the machine contained identical integrated circuits, the same part numbers with date codes which were prior to September 26, and now it contains date codes which are after September 26, what effect would this have on the operation of the Flicker, in your opinion?

A. None whatsoever.

Q. Could you please explain your basis for that?

A. Well, if the components are identical, it would run identically the same way, and it is normal in products that if for some reason a component fails or for some reason you take it out and replace it, you may have one with a later date code; but if they are identical components, they should not affect the operation of the device.

Q. Dr. Schoeffler, would a person of ordinary skill in the art have been able to practice the patented invention based on the disclosure in the printed patent and the program filed in the Patent Office?

A. It is my opinion, and I just stated it in conjunction with this structure chart and executive loop flow chart that I described, that he could.

Q Dr. Schoeffler, during your cross examination you stated that you thought that a debounce routine was used for the switches in the test line, but to make sure you would have to check the program to determine if this was true.

Have you had an occasion to check the program of the Flicker to determine whether a debounce routine was used on the switches which were connected to the test line?

A I examined the program during the break and determined that software was not used to debounce the switches on the test line, and in particular, of course, the slam and the tilt lines, it is not appropriate to debounce those. The whole idea is to respond quickly when those occur.

The debouncing of the other switches was apparently done by the duration of the routines that was associated with them. The length of time that it takes to do the coin response routine, for example, apparently was considered sufficient so that one did not have to use the same debounce routine that was used in the other switches.

However, all the other switches in the machine did use a debounce routine, and if it was necessary, that same routine could have been used with the other switches if Frederiksen had desired it.

Q What significance to the claimed invention, if any, does the fact that the switches in the test line of Flicker did not have a debounce routine, in your opinion?

A. That has no effect, in my opinion, on the reading of the claims, sir.

Q. Dr. Schoeffler, I hand up to you Plaintiff's Exhibit 469. It is a 3-page document, entitled "Infringement summary."

I ask you if you can identify it?

A. Yes, sir, this is a chart which I put together to summarize the various aspects that I have testified to for the various games so that I could keep them straight.

Q. Could you quickly go through and please explain what the various columns are and what is meant by what is contained in the infringement study?

A. Yes, sir. Column 1 in this summary is the name of the pinball game, and the three Williams representative games and the two Gottlieb representative games are all mentioned in the various columns. Then everything in the other columns is grouped for each of those games.

I believe this is an accurate summary of what I have found.

The second column in the summary is entitled "Microprocessor," and it simply indicates that in each of those games, there is a microprocessor doing control, as required by the claims, and that is the significance of the word "yes."

In addition, I listed the particular microcomputer. For example, the three Williams games used the Motorola 6800

family.

MR. GOLDENBERG: Your Honor, I object to this. The witness has prepared the document. I don't know that it requires all this explanation. It is a rehash of his direct testimony. I really think it is self-explanatory.

THE COURT: Well, if it is, I would like to let it go at that.

I was wondering myself. I mean, frankly, it is a helpful document for me to have. It is by way of a summary; it is not substantive evidence. It is a summary of what the witness has testified to, I assume.

MR. SCHNAYER: If the defendants agree it is self-explanatory --

THE COURT: If there is nothing in here that I wouldn't understand by reading these various captions, let's dispense with the explanation because it looks to me like I understand what it is.

MR. SCHNAYER: I think there is only one area which might need some explanation.

THE COURT: All right.

MR. SCHNAYER: Would you agree the rest of it is self-explanatory?

MR. GOLDENBERG: Well, it is self-explanatory as representing this witness' testimony, I suppose. Yes, I will agree to that.

THE COURT: Ask him the specific thing you want to ask him.

MR. GOLDENBERG: I don't know. Mr. Lynch, do you have any problem?

MR. SCHNAYER: You have no problem, Mr. Lynch?

THE COURT: I don't know that it makes any difference whether they have any problems or not. It seems self-explanatory to me.

MR. SCHNAYER: Thank you, your Honor. I am sorry.

THE COURT: I was waiting for some indication why it was necessary to explain it, and I haven't heard it yet. So let's not explain it, except for the one particular thing.

MR. SCHNAYER: The only column is the one where it says "Combination of Noise Prevention and Noise Immunity Techniques to Allow Operative Matrix Multiplexing," and then there is a list for each game of various items.

BY MR. SCHNAYER:

Q Could you just tell me what those things are listed?

A Yes, that one may not be self-explanatory because I restricted the things that I put in this to the things that were in the Flicker game or directly equivalent to the things in the Flicker game, so that I did not list additional hardware noise prevention-immunity techniques that might be in individual games in addition to it.

So that is restricted to those in the Flicker game.

The other columns I agree are self-explanatory.

THE COURT: All right.

BY MR. SCHNAYER:

Q. Dr. Schoeffler, referring to Mr. Lynch's exhibit he generated , I think this is 19-J.

Do you recognize that as a chart that was --

A. Yes, I do.

Q. Dr. Schoeffler, do you believe that this chart is accurate?

A. No, sir, I believe that it is misleading.

Q Could you please explain in what ways you think that chart is misleading?

A As I understood the purpose of the exercise in producing the chart was to show the differences between the Flicker, the preferred embodiment, namely, the Flicker machine, the single matrix machine itself, and the Gottlieb games, representative games, Cleopatra and Spiderman, but in several rows the way that chart was written down, it ended up being, in my opinion, misleading.

I will just give a couple of examples.

In the second row, where it is labeled "Switch Scan" and it is called "cyclic and sequential" under the Flicker and the preferred embodiment, I had indicated it was my opinion that it was cyclic and sequential for Cleopatra and Spiderman, but nothing was entered.

In the row that is labeled "Digit Scan", Flicker and the preferred embodiment, it is labeled "Cyclic and Sequential," and we had indicated that it was actually cyclical and sequential also for Cleopatra and Spiderman, but there instead of indicating the same words, so that the comparison was obvious, the names of the chip types, the hardware that are used there, were put in. As a consequence, when one reads this out of context, it gives the impression as though this were something different.

There is a similar thing in the solenoid lines and others, but at any rate, I just believe the chart as it

stands is misleading, sir.

Q Dr. Schoeffler, Mr. Lynch referred you to a portion of the testimony of Donald Harmer, and in that testimony it indicated that it was possible with a particular type of switch scanning that occurred on Cleopatra that a switch could be missed because of this particular technique of when it hit a switch closure, it started at the beginning.

He gave you only a portion of that testimony, and I would like you to read quickly through pages 136 and 139 and see if there is any conclusion by Mr. Harmer that would indicate that his testimony in that regard was incomplete.

(Brief interruption.)

BY MR. SCHNAYER:

Q Does Mr. Harmer indicate in there?

A Excuse me. I have to work through it, I am afraid.

MR. SCHNAYER: Excuse me.

(Brief interruption)

MR. SCHNAYER: I apologize for not having a copy for the Court.

THE COURT: It is all right.

(Brief interruption)

BY THE WITNESS:

A I notice down here on page 137 at line 23 where there is a series of questions about how often this would happen, and it says, "Do you recall any particular instances where?

He answers: "No," if that refers to whether --

BY MR. SCHNAYER:

Q So Mr. Harmer indicates in his testimony that he never observed any instances. He did not recall observing any instances where this happened?

A That is apparently what it means. It is an incomplete sentence, of course.

Q Now, if the designer of the game did not observe any instances -- assume that is the case -- is it your opinion that it is likely that the Cleopatra would have missed switch closures as Mr. Lynch inferred in his cross examination

questions?

A It is unlikely and, also, the fact that it was a commercial game and that it is a representative game, and presumably others were designed just like it that were sold. It is unlikely that it was a problem. It would hardly have been acceptable in the intended environment of the pinball machines.

Q Dr. Schoeffler, you testified previously about Williams and Gottlieb representative games.

You had answered some questions on cross examination about certain solenoids which were under control, microprocessor control.

Could you please describe generally, very generally, what the types of solenoids there were under microprocessor control pinball games?

A Yes, sir.

In our discussion, we had indicated that, in general, on these thumper bumpers and on the slingshot type of things that the solenoids were direct driven; that is, not caused to close by the action of the microprocessor itself except for an overall enabling; that is, permitting them to operate during the time that the game was active. There were several of those, approximately half in one set of games, for example.

Then the other half were solenoids that pop up

targets and throw the ball out of outholes and the like, and those were under computer control and processor control in those games.

So some of them were directly under the control of the processor, and some were so-called direct driven.

Q. Now, the ones that were directly under control in the microprocessor, did they have any real time response constraints associated with them on the microprocessor system?

A. Every event that can occur in a system like the pinball game ends up with some kind of real time response either because we have to kick out the ball in a reasonable time or we have to raise the switches in a reasonable time or because, and equally important, that because of other things going on concurrently, we have to synchronize things in real time.

For example, it was typical in the drop target. A drop target is a target that when the ball hits it, it falls down, and at a later time under the game rules, the solenoid has to pop them up.

When the target drops, you want to give the player credit for hitting the target, but when it jumps up again, he should not get any score increment.

So the real time constraint then requires that while that solenoid is being closed, for example, you do not do switch scanning. So this then becomes a combination of events that have to be carried out that way.

So they all enter into the design of the game because of the simultaneous events.

Q Now, Dr. Schoeffler, you discussed software techniques that were described in the program listing that was filed with the patent.

My question is, are there any software techniques for noise prevention -- noise immunity, excuse me, which were actually described in the text of the patent itself?

A Yes, sir. The offset in time or the time interlock is disclosed very explicitly in the patent.

And at the very beginning of my direct testimony when I went through noise references, that appears several times in the text of the patent, and I referenced as part of that testimony.

Q What is the approximate scan rate for the matrix multiplexing system disclosed in the patent?

A As disclosed in the patent it is approximately 60 times per second.

Q What is the approximate scan rate for the switch matrix in the Disco Fever, Flash, or Black Knight games? Those are the Williams games. This is the switch scan rate.

A The switch scan rate in the Disco Fever, which is done in the background, I was not able to determine. I don't -- of course, don't have access to the programs, and there was no testimony about that.

When it was done in the Flash and Black Knight games, the next two representative games, it was done on an

interrupt basis, and the entire matrix was scanned 500 times a second. Very much more rapidly.

Q What significance if any does this have, this faster scan rate have with respect to aborting of the switch scan if it finds a switch that's closed and go back and start again?

A In that game the switches are being looked at so often, okay, it almost doesn't matter in what sequence they are done.

But in fact aborting the scan would make it highly unlikely that one would miss a switch closure, because you're coming back to them so very, very rapidly.

THE COURT: It's six o'clock. I suppose we'll quit for the night.

MR. SCHNAYER: Thank you, your Honor. I should be close to --

THE COURT: And I've got a doctor's appointment at 9:30 tomorrow, and I hope it will be over in time for me to be here by eleven. And if I'm not here at eleven, I will be, I assume, very shortly thereafter.

So we'll shoot for eleven o'clock. Okay.

MR. SCHNAYER: Thank you, your Honor.

(The above-entitled cause was recessed until the following day at 11:00 o'clock a. m.)

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